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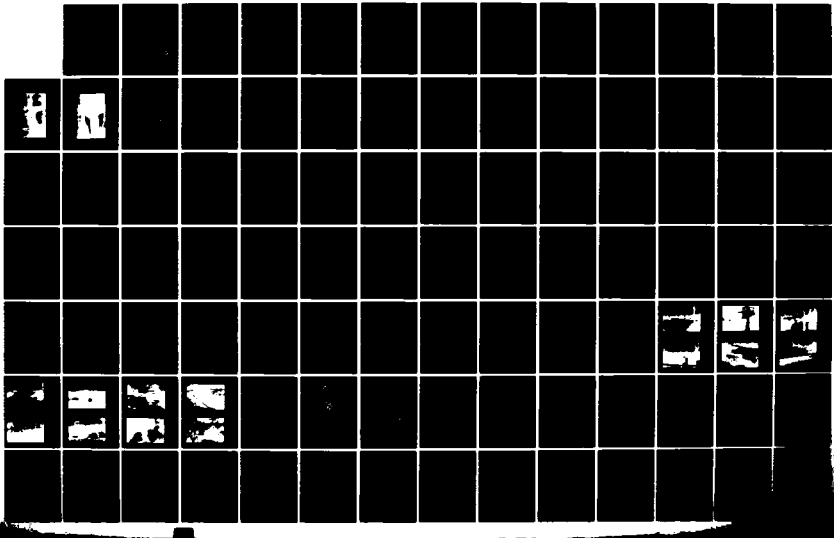

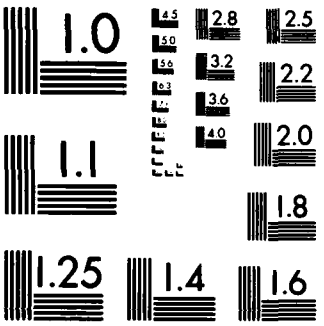

(2)

PENNAMAQUAN RIVER BASIN
Pembroke, Maine

PEMBROKE COTTAGE MAIN DAM
ME 00294
AND
EAST DAM
ME 00721

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
Waltham, Mass. 02154

SEPTEMBER 1981

UNCLASSIFIED

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Pennamquan River Basin
Pembroke Maine
Pennamaquan River

20 ABSTRACT (Continue on reverse side if necessary and identify by block number)

The main dam is 188 ft. long and 20 ft. high. The east dam is 118 ft. long and 9 ft. high founded on bedrock. The main dam was found in fair condition, while the east dam was found in poor condition. Both dams are classified as large in size with hazard potentials of high. It is recommended that the owner engage a qualified engineer to design and supervise repaor of the concrete wall of the main dam.

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Pembroke, Maine

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PHASE I INSPECTION REPORT
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NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT

Identification No.:	ME 00294 & ME 00721
Name of Dam:	Pembroke Cottage Main Dam and East Dam
Town:	Pembroke
County & State:	Washington County, Maine
Stream:	Pennamaquan River
Date of Inspection:	November 12, 1979 and August 10, 1981

BRIEF ASSESSMENT

The Pembroke Cottage Main Dam and East Dam are constructed on a site originally utilized for power in 1832 and currently used to maintain a waterfowl pool. The Main Dam is 188 feet long and 20 feet high. The dam is an old timber crib structure filled with cinder and slag which was later faced with a concrete wall on the upstream slope and a dry masonry wall on the downstream slope. The principal spillway is a bi-level opening in the concrete wall. A timber gate controls flow thru a 7' 0" steel penstock stub in one of two masonry arches. The second masonry arch was filled except for a small slot controlled by timber stop logs.

The East Dam is a concrete gravity structure 118 feet long and 9 feet high founded on bedrock. The spillway is a low concrete weir 49' 10" long. There is also a screw operated timber gate structure and a sluiceway which discharges flow thru a series of two fishways.

The Main dam was found in fair condition. The concrete wall on the upstream face has several longitudinal cracks and is spalling at the water line due to ice action. There are two large trees growing on the embankment and the quality of the embankment fill is unknown. The crest of the dam has a well developed grass cover and is presently being used as a picnic area.

The East Dam is in poor condition. The low wall on the left abutment area is in an advanced state of deterioration. There are extensive holes at the base of the wall and one small section has already partially failed. The base of the gate structure has broken away from the sidewalls which are experiencing extensive cracking.

Based on a maximum storage of 96,000 acre-feet, the projects fall within the large size classification. The dam's hazard classification has been established as high based upon the fact that the failure would result in the loss of more than a few lives. The test flood used was equivalent to the Probable Maximum Flood. The test flood for the 39.0 square mile

drainage area yielded an estimated peak inflow of 14,400 cfs. The computed PMF inflow raised the reservoir level to EL. 60.3. This level was below the embankment crest of 61.2 on the Main dam, however the East dam at crest El. 58.5 would be overtopped by 1.8 feet. The computed combined outflow for the test flood was 2,100 cfs. The project discharge capacity at El. 58.5 is 560 cfs or 27% of the test flood outflow.

It is recommended that the owner obtain the services of a registered professional engineer for the Main dam to design and supervise repair of the concrete wall, establish the integrity of the embankment material, design and supervise an on-site lifting device for the gate and supervise removal of the trees on the embankment. For the East dam the services of a registered professional engineer should be retained immediately to design and supervise reconstruction of the wall left of the gate structure and the gate structure itself. Also for the Main dam, the owner should immediately investigate and establish ownership. Remedial measures common to both structures include monitoring the project during periods of intense rainfall and high run off associated with snow melt; implementing a monthly visual inspection program; developing a downstream warning system; conducting annual technical inspections; establishing routine operation and maintenance procedures; repairing all minor concrete damage; continue mowing the grass at the Main dam at least once a year; and remove the brush and trees from the toe of the downstream slope of the Main dam. These measures should be implemented within 12 months of receipt of this report, except as noted otherwise.

J.E. Giles, Jr., P.E.
Project Manager
Massachusetts Registration No. 1643

CORPS OF ENGINEERS

SIGNATURE PAGE

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety inspection of Dams, for Phase I investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of Phase I investigation: however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

The Phase I Investigation does not include an assessment of the need for fences, gates, no-trespassing signs, repairs to existing fences and railings and other items which may be needed to minimize trespass and provide greater security for the facility and safety to the public. An evaluation of the project compliance with OSHA rules and regulations is also excluded.

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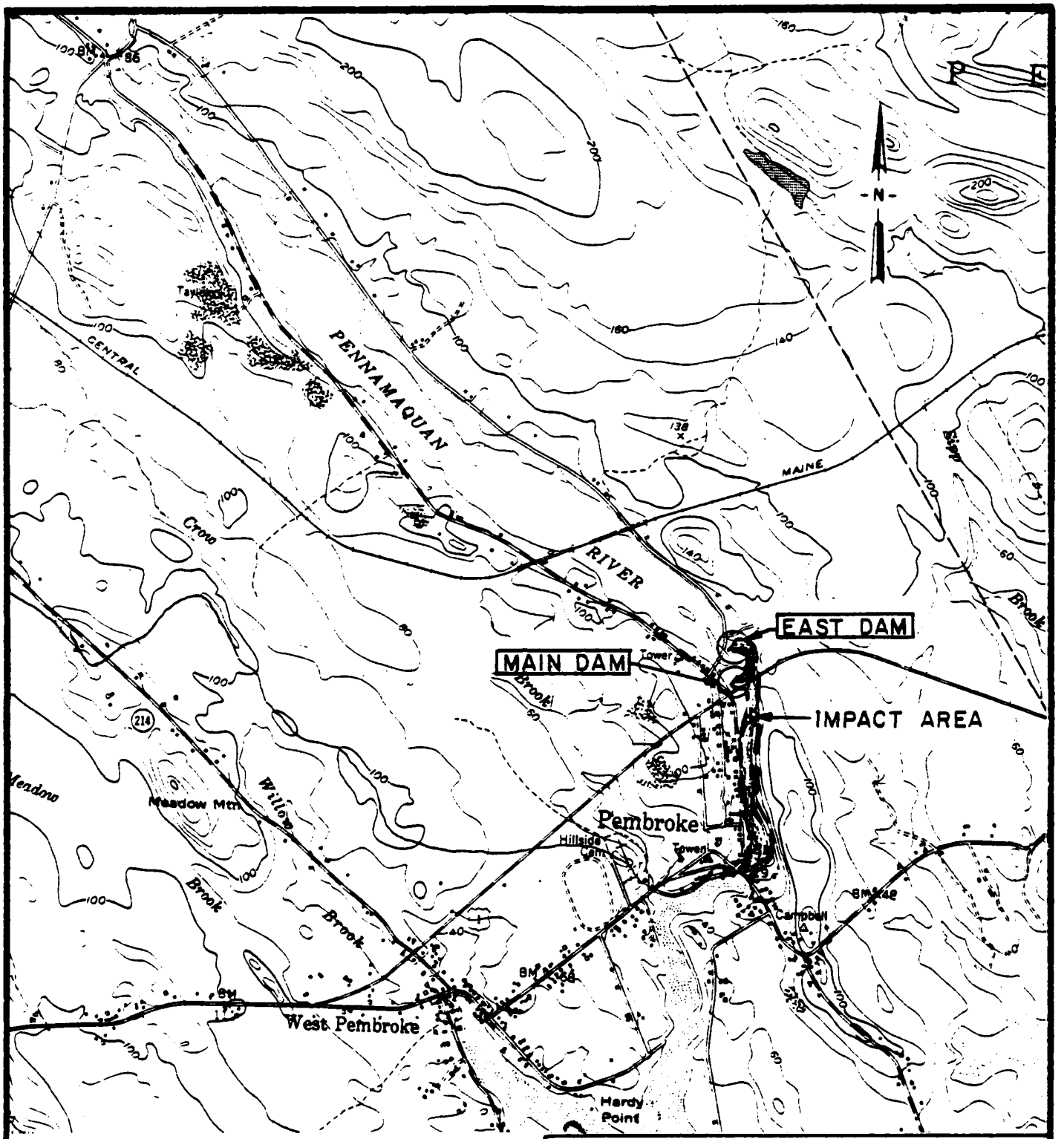
APPENDIXES

No. 1 Main Dam from left Abutment.

No.2 East Dam from Left Abutment



MAINE

Vicinity Map

FROM U.S.G.S. 7.5 MIN. QUADRANGLE MAP PEMBROKE, MAINE.

2000 0 2000

SCALE: 1" = 2000'

PEMBROKE COTTAGE MAIN DAM & EAST DAM LOCATION MAP

U.S. ARMY CORPS OF ENGINEERS
PHASE I INSPECTION PROGRAM

MAIN

DATE SEPT. 1981

CLIENT 100 PLATE
1345 72

NATIONAL DAM INSPECTION PROGRAM

PHASE I INSPECTION REPORT

PEMBROKE COTTAGE MAIN DAM
AND EAST DAM
PEMBROKE, MAINE

SECTION I

PROJECT INFORMATION

1.1 General

a. Authority - Public Law 92-367, August 8, 1972 authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Chas. T. Main, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Maine. Authorization and notice to proceed were issued to Chas. T. Main, Inc. under a letter of November 6, 1979 from Max B. Scheider, Colonel, Corps of Engineers. Contract No. DACW 33-80-C-0011 has been assigned by the Corps of Engineers for this work.

b. Purpose - The purposes of the inspection program are:

(1) To perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner of non-Federal interests.

(2) To encourage and prepare the states to initiate effective dam safety programs for non-Federal dams.

(3) To update, verify and complete the National Inventory of Dams.

c. Scope of Inspection Program - The scope of this Phase I inspection report includes:

(1) Gathering, reviewing and presenting all available data as can be obtained from the owners, previous owners, the state and other associated parties.

(2) A field inspection of the facility detailing the visual condition of the dam embankments and appurtenant structures.

(3) Computations concerning the hydraulics and hydrology of the facility and its relationship to the calculated flood through the existing spillway.

(4) An assessment of the condition of the facility and corrective measures required.

It should be noted that this report does not pass judgment on the safety or stability of the dam other than on a visual basis. The inspection is to identify those features of the dam which need corrective action and/or further study.

1.2 Description of Project

a. Location - The two structures Pembroke Cottage Main Dam and East Dam are located on the Pennamaquan River in the township of Pembroke, Washington, County. The two sites just north of the U.S. Rte. 1 Bridge span the channels on either side of Puttys Island. The latitude and longitude of the two sites are N 44° 57' 48" and W 66° 09' 5". Discharge from the Main dam flows about 300 ft. to join the main channel discharge from the East dam. From there, the river flows an additional 2500 ft. to its tidal estuary.

b. Description of Dam and Appurtenances - The Pembroke Cottage Main dam is a cinder and slag fill embankment with a dry masonry wall on the downstream face and a concrete wall on the upstream face. The overall length of the embankment is 188 feet. The dam's height is about 20 feet. There are two masonry arches in the embankment. One has a gated penstock stub and the other has a small slot. There is also a spillway near the left abutment.

The embankment was originally a timber crib structure founded on bedrock. The crib was filled with cinders and slag from the smelter. The stone masonry face and concrete face were added later. The top width of the embankment varies from 15 feet to 28 feet. The crest at El. 61.2 has a well developed grass cover.

The spillway is a bi-level slot in the concrete wall. The first level (at El. 55.0 is 40 inches wide and 36 inches high. The length expands to 88 inches wide at El. 58.0, 24 inches on each side of the lower slot. There is a small wooden foot bridge 11 feet 4 inches long over the spillway.

The arch with the penstock stub is 13' 5" wide and about 10 feet high at the peak. The penstock stub is a 7 foot diameter steel pipe. The opening has been covered at the upstream face by the concrete wall and the penstock has been equipped with a timber and steel gate which is operated by jacks.

The second arch is 5 feet wide and about 10 feet high. The upstream opening of this arch was also covered by the concrete

wall. A 3 feet wide x 12 inches high opening invert El. 57.0 was left at the peak of the arch. The opening is controlled by timber stop logs.

The discharge from the spillway cascades over exposed bedrock into a channel which is parallel to the Route 1 embankment. This channel is masonry wall lined except for directly downstream of the penstock stub where a concrete retaining wall was recently constructed to protect the Route 1 embankment.

The East dam is a low concrete gravity structure founded on bedrock. The overall length of the structure is about 118 feet including the spillway which is 49' 10" long. The dam also includes a service gate and a sluiceway which discharges flow to the fish ladder. The dam's height is about 8 feet.

The dam cross section varies. The first 20 feet left of the gate structure is 4 feet 6 inches wide at the top with an average height of 5 feet. The dam then turns about 60° upstream for a distance of about 15 feet where it blends with exposed bedrock. The dam in this section is 1' 6" wide at the top with a 1 Horizontal on 2 Vertical batter on the downstream side and an average height of 3 feet 6 inches. Beyond the exposed bedrock is a low concrete section about 15' 6" long and 26" in height. In this section there are two 2 foot wide openings slotted for flashboards.

The gate is a 7' 8" wide x 7' high timber sluice gate which is screw operated. The gate structure is also fitted with stop log slots.

There are two fish ladders at the left abutment. The first ladder is about 60' long and discharges into a lower pool which is controlled by a 24" high concrete gravity wall fitted with a 24-inch wide slot. The structure maintains a pool level which allows discharge through a second ladder about 50' long which discharges into the main channel about 200' downstream of the dam.

The spillway is only 1-2 feet of concrete founded on bedrock with a length of 49' 10".

A roadway crosses the river and Puttys Island upstream of both structures. Upstream of the Main dam the river flows under the road through a 36" CMP at approximate invert El. 54.0. A small concrete structure exists about 20' downstream of the roadway. The structure has two openings at the base 4' 6" wide and of an unknown height and invert. This structure is about 100 yards upstream of the main dam. About 100 feet upstream of the East dam the roadway crosses a wooden bridge over the channel. The opening below the bridge is 13' wide and 9.5' high.

c. Size Classification - The storage to the top of the East dam is considered storage for both structures and is estimated to be 96,000 acre/ft. The hydraulic height of the East dam is 9 feet and the Pembroke Cottage dam is 20 feet. Both dams are classified as "large" in size due to storage only (50,000 Ac./Ft.) according to guidelines established by the Corps of Engineers.

d. Hazard Classification - To establish hazard classification the two sites were looked upon as a single structure with the East dam being considered an emergency spillway and the Main dam assumed to be failing. Dam failure analysis computations in Appendix D, which are based upon "Guidance for Estimating Downstream Dam Failure Hydrographs" and the previous noted assumption indicate that the dam should be classified as having a "high" hazard potential. A failure of the structure could result in the loss of more than an few lives.

e. Ownership - In 1957 Bangor Hydro-Electric Co. sold both structures to the State of Maine, Department of Inland Fisheries and Wildlife who still operates and maintains the site. The name, address and phone number of the responsible person is:

Mr. Robert Boettger
Chief Wildlife Division
Department of Inland Fisheries
and Wildlife
Augusta, ME
1 - (207) 289-3651

Mr. Frank Sutton, who owns the property adjacent to the Main dam, reported to the inspection team that he owned the Main dam. However, the survey plan in Appendix B shows that the structure was sold to the state.

f. Operator - The person responsible for the day to day operation of both structures is:

Mr. Hank Carson
Regional Wildlife Biologist
Machias Regional Office
Wildlife Division
Department of Inland Fisheries
and Wildlife
Water Street
Machias, ME
1 - (207) 253-3266

Mr. Frank Sutton, although not the owner, has been maintaining and operating the Main dam since he purchased the adjacent property in 1975.

g. Purpose - The site was originally developed to provide power for a smelter and foundry in 1832. In the early 1900's, Bangor Hydro acquired the site and installed a turbine in the old Iron Works building. Bangor Hydro sold the two structures to the State of Maine in 1957. The Dept. of Inland Fisheries and Wildlife has used the structures to maintain a water fowl area in the reservoir and to maintain the fishway principally for alewives.

h. Design and Construction History - The history of the dam is somewhat obscure, but according to local historians, the site was developed by General Ezekial Foster around 1832 to provide power for a smelter and foundry. It was purchased by Gray & Co. of Boston, then sold to William Coffin & Co. in 1849, who operated it for many years before selling it to Bangor Hydro-Electric Co. A 1944 drawing from the files of Bangor Hydro show cross sections of the power plant (See Appendix B) downstream of what was noted as the main dam for the Iron Works Power Plant. The generator had a rated capacity of 15 KVA @ 450 RPM.

In 1945 the "north dam" channel and surrounding land were sold to a private citizen. Mr. Frank Sutton acquired this property about 1975. The "Main dam and East dam" as noted on the drawing, were sold to the State in 1957. A survey drawing relative to this transfer is included in Appendix B.

i. Normal Operating Procedures - There is no formal written procedure for the operation of the dam. Water levels are maintained behind the main dam by the spillway and the 3' slot in the archway. The major portion of the river flow discharges at the East dam over the uncontrolled spillway, and through the two slots to the fish ladders. The gate and the flashboards are operated to maintain a stable reservoir level for water fowl.

1.3 Pertinent Data

a. Drainage Area - The project controls a drainage area of 39.0 square miles. The watershed is gentle sloping terrain with a range of watershed Elevations from El. 400.0 to El. 60.0. There are two structures in the upper drainage area. One controls Round Lake and the second controls Pennamaquam Lake. In addition a railroad trestle crosses the reservoir area about half a mile upstream of the dams and could retain water if it became clogged with debris.

b. Discharge at Damsite

(1) Outlet Works - At the east dam a screw operated 7'8" x 7' timber sluice gate is located at invert El. 51.5. The principal spillway crest is at El. 57.0.

At the Main dam, the principal spillway crest is at El. 55.0. The timber gate for the 7' 0 penstock stub is at El. 47.0. The timber stop log for the slot in the other archway is at El. 57.0.

(2) Maximum known flood - Unknown.

(3) Principal spillway capacity at top of dam.

a.	East dam	430 cfs @ El. 58.5
b.	Main dam	320 cfs @ El. 61.2

(4) Principal spillway capacity at emergency spillway crest elevation - 60 cfs @ El. 57.0.

(5) Gated spillway capacity at normal pond elevation - N/A.

(6) Gated spillway capacity at test flood elevation - N/A.

(7) Spillway capacity at test flood elevation.

a.	East dam	1250 cfs @ El. 60.3
b.	Main dam	250 cfs @ El. 60.3

(8) Total project discharge at top of dam.

560 cfs @ El. 58.5	(Top of East dam)
3250 cfs @ El. 61.2	(Top of Main dam)

(9) Total project discharge at test flood elevation - 2100 cfs @ El. 60.3.

c. Elevations (feet above NGVD)

(1)	Stream bed at toe of dam	
	East dam	50.5
	Main dam	41.2
(2)	Bottom of cutoff	N/A
(3)	Maximum tailwater	Not available
(4)	Normal pool	57
(5)	Full flood control pool	N/A
(6)	Principal spillway crest	
	East dam	57.0
	Main dam	55.0
(7)	Emergency spillway crest	57.0
(8)	Design surcharge	Unknown

(9)	Top of dam	
	East dam	58.5
	Main dam	61.2
(10)	Test flood surcharge	60.3

d. Reservoir (length in feet)

(1)	Normal pool (Emergency Spillway Crest)	12,600
(2)	Flood control pool	N/A
(3)	Emergency spillway crest pool	12,600
(4)	Top of dam	12,600
(5)	Test flood pool	12,600

e. Storage (acre-feet)

(1)	Normal pool (Emergency Spillway Crest)	85,000
(2)	Flood control pool	N/A
(3)	Emergency spillway crest pool	85,000
(4)	Test flood pool	111,500
(5)	Top of dam	96,000 @ El. 58.5 115,000 @ El. 61.2

f. Reservoir Surface (acres)

(1)	Normal pool (Principal Spillway Crest)	12,400
(2)	Flood-control pool	N/A
(3)	Emergency Spillway Crest	12,400
(4)	Test flood pool	13,900
(5)	Top of dam	13,100 @ El. 58.5 14,500 @ El. 61.2

g. Dam		Main dam	East dam
(1)	Type	Slag and cinder timber crib with Masonry D/S face and concrete upstream face.	Concrete Gravity
(2)	Length	188 feet	118 feet

(3)	Height	20 feet	9 feet
(4)	Top Width	15-28 feet	4.5-13 feet
(5)	Side Slopes	Vertical	Varies
(6)	Zoning	N/A	N/A
(7)	Impervious Core	Slag and cinder fill	N/A
(8)	Cutoff	N/A	N/A
(9)	Grout Curtain	None	Unknown
(10)	Other	N/A	Founded on bedrock

h. Diversion and Regulating Tunnel - None

i. Spillway		Main dam	East dam
(1)	Type	Concrete	Concrete
(2)	Length of Weir	40" @ El. 55.0 88" @ El. 58.0	49' 10"
(3)	Crest Elevation	El. 55.0 & 58.0	El. 57.0
(4)	Gates	Ungated	Ungated
(5)	U/S Channel	N/A	Natural
(6)	D/S Channel	Exposed Bedrock	Exposed Bedrock
(7)	General	N/A	N/A

j. Regulating Outlets

Main dam		i	ii
(1)	Description	Steel penstock stub	Slot in masonry arch
(2)	Size	7' 0"	12" x 36"
(3)	Invert	Approx. El. 47.0	Approx. El. 57.0
(4)	Control Mechanism	7' timber and sluice gate operated by jacks	Timber stop logs

(5)	Other	N/A	
East dam		i	ii
(1)	Description	Sluice gate	Approach to fish ladders
(2)	Size	7' 8" wide by 7' high	2 openings - 24" wide x 26" high
(3)	Invert	El. 51.5	56.5
(4)	Control Mechanism	Sluice gate, screw operated	Wooden stop logs, structure is slotted
(5)	Other	N/A	

SECTION 2

ENGINEERING DATA

2.1 Design Data

A copy of Drawing No. R-35, General Plan, Little Falls & Iron Works Plants, dated May 8, 1944, was obtained from the files of Bangor Hydro-Electric Co. A.1957, survey of the property sold to the state was also found. Both plans are included in Appendix B.

2.2 Construction

It is not known exactly when Bangor Hydro acquired the site, but it is believed that they made only minor modifications to the site, including filling the arches and installing the penstock and its gate. It is believed these modifications were made in the early 1900's. The sequence of construction at the site prior to this is unknown. The retaining wall on the discharge channel was constructed recently by Mr. Frank Sutton.

2.3 Operation Data

No operational data were located. The flashboards at the East dam were reportedly placed or removed periodically to maintain a constant reservoir level.

2.4 Evaluation

a. Availability: The drawings as noted in Section 2.1 were all the information available for review.

b. Adequacy: The lack of design calculations did not allow for a definitive review. Evaluation was based on visual inspection, past performance history, and sound engineering judgement and experience.

c. Validity: The limited data available restrict evaluation of the Pembroke Cottage Main dam and East dam to the visual inspection and sound engineering judgement.

SECTION 3

VISUAL INSPECTION

3.1 Findings

a. General - The Phase I visual inspection of Pembroke Cottage Main Dam was conducted on 15 November 1979. The upstream water surface elevation was approximately 4' below the top of the dam or El. 57.2

In general, the project was found to be in fair condition. Several deficiencies were noted regarding the concrete wall on the upstream face of the dam.

The Phase I visual examination of the East dam was conducted on 10 August 1981. The upstream water surface elevation was about 4" over the spillway or El. 57.3

In general, the project was found to be in poor condition. The concrete wall left of the gate structure is exhibiting severe signs of distress.

A visual inspection checklist for each dam is included in Appendix A and selected photographs of the dams are given in Appendix C.

MAIN DAM

b. Dam - In general, the dam is in fair condition. The crest of the dam has a well maintained grass cover which is utilized as a picnic area. There are some irregularities in the vertical alignment of the earthen portion of the crest. A post and rail fence runs along the back edge of the crest. There are two large diameter trees in the embankment. One adjacent to the spillway and the other near the right abutment. There are also some smaller trees and brush growing near the spillway.

The concrete wall on the upstream face is exhibiting signs of distress. Within the 4 foot zone visible during the inspection, several hairline longitudinal cracks 20-60 feet in length were noted. Some efflorescence was also noted. The zone at the waterline was experiencing spalling due to ice action.

The dry masonry wall on the downstream face appears to be in good to fair condition. There is a low area in the wall left of the arch with the penstock stub. The embankment crest has experienced some erosion in this area in the past. At the base of the wall left of the smaller arch a tree (12" Ø) was noted.

The downstream toe of the dam was generally dry with no seeps or boils noted.

c. Appurtenent Structures - The timber gate on the 7' diameter penstock stub is generally in good to fair condition. The gate was leaking as evidence by the flow visible in Photo 4. The wooden platform above the gate is in good condition. The gate is reportedly lifted by jacks. This operation was not demonstrated during the inspection, however reportedly the operation had been executed twice in past years to dewater the pond. The penstock stub was rusting but overall was in good condition.

The spillway is in good condition with no visible signs of distress. The walkway atop the spillway is well maintained and in good condition.

d. Reservoir Area - The pond area directly controlled by the Main dam is about 300 feet long and 200 feet wide at the dam. A small dam (North dam) and the 36" Ø culvert under the roadway (See Photos No. 7 & No. 8) control the flow to the pond. The pond is bordered by a forested Puttys Island on the left shore and a light residential zone on the right shore.

e. Downstream Channel - The downstream channel was clear with no evidence of debris. The masonry wall lining the channel was generally in good condition as was the recently constructed concrete wall.

EAST DAM

b. Dam - The concrete gravity wall is in poor condition. Left of the gate structure this wall's maximum height is about 6'. The wall is founded on bedrock and there is generally seepage along the entirety of the downstream toe. The entire crest of this section is spalling (1/4") in addition the upstream face is experiencing spalling up to 2-3" in depth. The downstream toe of the concrete in this section is generally 3-4" from the bedrock and as much as 12" in other areas. The 15 foot section of the dam at the left corner has already failed. A 3 foot section of the wall has fallen about 1/4". There is a hole on the upstream side of the wall at this location 1' 8" high and about 2' wide. The hole on the downstream side measures 14" high, 4' wide and 13" deep.

The small section which allows flow to the fishways is generally in good condition. The concrete is experiencing minor spalling. The sluices are slotted for flashboards and 6" were in place at the time of inspection.

c. Appurtenant Structures - The gate structure is in poor condition. The base slab of the structure has separated from the side walls for a distance of 3-4" up from the downstream toe. The side walls are also experiencing extensive cracking. The gate is leaking but not seriously. The steel channel housing, the timber gate and the lifting mechanism is generally in good condition. The spindle is slightly bent and

the housing is experiencing minor rusting. The gate was not operated during the inspection but it had been reportedly operated in the recent past.

The spillway was not visible at the time of inspection. However, several points were noted. Bedrock outcrops broke the cascade of the spillage generally 12-24 inches below the crest except for a small section (7-10 feet) near the gate structure. Photos taken during the 1979 inspection noted pins and flashboards on the spillway which were not there at the time of the August, 1981 inspection.

d. Reservoir Area - This structure controls a rather large reservoir area relative to its height. The reservoir is bordered by generally flat forrested terrain. The reservoir is long and narrow with a length of about 12,800 feet and an average width of about 800 feet. There are two crossings in the reservoir area, the roadway about 100 feet upstream of the dam and a railroad trestle about 2,500 feet upstream. The railroad trestle does present the potential to collect debris and act as a dam during high flows.

e. Downstream Channel - The downstream channel is exposed bedrock and is generally free of debris and overhanging trees. A small training wall about 2' high and 20' long keeps discharge from the spillway and the gate from the lower fishway pool.

3.2 Evaluation

In general, the Main dam is in fair condition, No urgent or emergency repairs are required, however, several deficiencies were noted. Although the structure has withstood the test of time, the condition of the concrete wall and the large trees on the embankment are of concern, due principally to the unknown quality of the embankment material. In addition the lack of an on site lifting mechanism for the gate on the penstock stub could prove dangerous if an emergency situation did arise at the site. Recommendations relative to these deficiencies and remedial measures for several minor deficiencies are noted in Section 7 of the report.

In general, the East dam is in poor condition. The dam left of the gate structure could fail this winter with the increased loads presented by ice. Although this failure represents little or no hazard, the owner would lose control of the reservoir levels. Recommendations relative to this and other major deficiencies as well as remedial measures for several minor deficiencies are noted in Section 7 of the report.

SECTION 4

OPERATIONAL AND MAINTENANCE PROCEDURES

4.1 Operational Procedures

a. General - There are no formal operational procedures for either dam. Flashboards are utilized at the East dam to maintain a constant reservoir level throughout the water fowl season. It was reported that they are reluctant to operate the gate at the East dam due to difficulty in closing. Reportedly Mr. Frank Sutton, who owns the restaurant and motel adjacent to the structure, has operated the gate at the penstock opening at the Main dam at least twice in the past to drain the mill pond and repair the front face of the dam.

b. Description of Downstream Warning System - No warning system or emergency evacuation plans are in effect for this project.

4.2 Maintenance Procedures

a. General - There are no established procedures or manuals for inspection and maintenance of either structure. As noted previously, Mr. Frank Sutton has been maintaining the Main dam since he purchased the adjacent property in 1975. The site is being maintained as a recreation area in conjunction with the hotel. He has also constructed and maintains the retaining wall at the discharge channel to protect the Route 1 embankment.

b. Operating Facilities - There are no formal procedures for maintenance of the operating facilities. The gate on the penstock stub at the Main dam has reportedly been operated recently. The other facilities require no operation to pass flows. The gate on the East dam is generally in good condition. It was reported that the gate had been operated recently. Flashboards are used on the approach wall to the fishway. The spillway at the time of the first inspection was equipped with pins for flashboards which were gone at the time of the second inspection.

4.3 Evaluation

There are currently no formal operation or maintenance procedures in effect. Formal written operation and maintenance procedures, as well as a downstream warning system and emergency preparedness plan should be established.

SECTION 5

EVALUATION OF HYDROLOGIC AND HYDRAULIC FEATURES

5.1 General

The watershed is 39 square miles of undeveloped flat terrain. The Main dam is located on the Pennamaquan river about 0.45 miles upstream from the bridge of Route 1 at Pembroke Village. The embankment develops sufficient storage to reduce the Probable Maximum Flood (PMF) peak from 14,400 cfs to 2,100 cfs (about 85% reduction).

5.2 Design Data

The dam was built in the 1830's and no information is available by whom it was designed. There are two dams, the Main dam, and the East dam. The top of the dam elevations are 61.2 and 58.5, respectively. The maximum height of the Main dam is about 20 feet. The principal spillway is a sharp crested weir. The East dam was assumed to function as an emergency spillway for the Main dam. At the East dam, the spillway is 49' 10" long at crest elevation 57.0, and the remainder of the dam is at crest elevation 58.5. Each section is a sharp crested weir.

5.3 Experience Data

There are no records of past flood discharge or reservoir levels.

5.4 Test Flood Analysis

Based upon "Preliminary Guidance for Estimating Maximum Probable Discharge", dated March 1978, the watershed classification (flat-coastal), and hydraulic computations, the test flood for this high hazard, large size dam is equivalent to the PMF which was estimated to be 14,400 cfs. The flood routing starting elevation was selected to be the spillway crest elevation of the East dam, elevation 57. For this particular portion of Maine, the PMF runoff is assumed to be 13". The routed test flow outflow was determined in accordance with Corps of Engineers "Guidance for Estimating Effect of Surcharge Storage in Maximum Probable Discharges", and the hydraulic characteristics of the dam. The volume of the inflow hydrograph was found to raise the reservoir level 3.3 feet to El. 60.3. The combined project discharge for this elevation is 2,100 cfs. The top of the Main dam is elevation 61.2 feet and thus it would not be overtopped. The crest of the East dam is at El. 58.5, thus it would be overtopped by 1.8 feet. The total project discharge at El. 58.5 is 565 cfs (430 cfs at East dam and 135 cfs at Main dam) or 27% of the test flood.

5.5 Dam Failure Analysis

The volume in the pond between the Main dam and the North dam (See Appendix C, Pg. C-2) which corresponds to water surface elevation 60.3 feet (maximum water surface elevation) is 40 acre-feet. It was assumed that with a failure at the Main dam the North dam would remain and control project discharge, thus limiting the volume considered at the time of failure to 40 acre-feet between the structures. The impact of failure was assessed by using the "Rule of Thumb, Guidance for Estimating Downstream Dam Failure Hydrographs" prepared by the Corps of Engineers. The breach discharge was estimated with the water surface elevation at the maximum during a PMF event. The breach width was selected to be 35 percent of the length of the Main dam at mid-height. The downstream discharge at the time of failure was calculated as a sum of the breach discharge and the total project discharge prior to failure. This peak discharge was estimated to be 7,950 cfs. The result of these calculations are included in Appendix D.

In view of these results it can be concluded that a failure would increase prefailure water depths downstream from 2 feet to 4 feet. In the event of a dam failure at least five homes would be impacted in the river reach from the Route 1 bridge to the bridge at the start of the tidal estuary. This wave would flood these homes about 1-3 feet. Thus, this dam represents a high hazard structure since it can be assumed that more than a few lives could be lost in the event of a dam failure.

SECTION 6

EVALUATION OF STRUCTURAL STABILITY

6.1 Visual Observations

On the Pembroke Cottage Main Dam there was no visual evidence of settlement, lateral movement or other signs of structural instability in the structure. Some slight irregularities were noted in the vertical alignment of the earthen embankment behind the concrete wall on the face of the dam. However, the top of the concrete wall appears true to line and the irregularities in the earthen portion does not warrant any concern.

The East dam is exhibiting several signs of structural distress. About a 3' section of the wall has dropped about 1/4". There is a large hole on the upstream and downstream side of the section and a large amount of seepage was noted (See Photo 16). On the remainder of the wall there is a visible gap at the downstream toe between the concrete and the bedrock. At the gate structure the base slab has broken away from the structure 3-4".

6.2 Design and Construction Data

Original design calculations and construction records were not available for review in preparing this report. The drawing from the files of Bangor Hydro-Electric Co. was the only information found relative to the site.

6.3 Post Construction Changes

Since 1832, the site has been utilized. There has been a continual metamorphosis of the structures since that time as they were modified to suit the purpose of each of the owners. This is evidenced at the Main dam by the addition of the concrete wall, the addition of the penstock and the filling in of the arches. The most recent addition was the training wall in the downstream channel which protects the Route 1 embankment.

6.4 Seismic Stability

The dam is located in Seismic Zone No. 2 and, in accordance with recommended Phase I guidelines, does not warrant seismic analysis.

SECTION 7

ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition - The visual inspection of the East dam indicates that the structure is in poor condition. The structural problems with the wall and the gate structure are of prime concern and will require immediate attention.

The visual inspection of the Main dam indicates that the structure is in fair condition. Although there were no signs of impending failure which warrant urgent remedial action, conditions regarding the concrete wall, the nature of the embankment material and the trees on the crest of the embankment, were noted which will require attention.

b. Adequacy of Information - The lack of in-depth engineering data did not allow for a definitive review. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data but is based primarily on visual inspection, past performance history and sound engineering judgement.

c. Urgency - The remedial measures and recommendations presented below should be implemented by the owner within one year of receipt of this Phase I Inspection Report, excepted as noted otherwise.

7.2 Recommendations

a. Due to the poor condition of the concrete at the East dam, it is recommended that the Owner immediately obtain the services of a registered professional engineer to investigate the stability of the structure and design a repair scheme to be implemented within 12 months of receipt of this report.

b. In regards to the Main dam, the owner should obtain the services of a registered professional engineer to:

(1) Investigate the stability of the embankment;

(2) Design and oversee repair of the concrete wall on the upstream face;

(3) Design and oversee installation of a lifting device on the gate at the penstock stub;

(4) Complete a set of drawings for both sites; and;

(5) Oversee the removal of the trees including the trunk and root system, on the crest.

7.3 Remedial Measures The Owner should:

a. Establish ownership of the Main dam.

b. Develop a downstream warning plan to be implemented in the event of an emergency at the dam.

c. Establish a system to monitor the project during periods of intense rainfall and high runoff associated with snowmelt.

d. Implement a monthly visual inspection program of the dam and appurtenances. Observations should be noted in a maintenance log.

e. Conduct a technical inspection of the project every year.

f. Establish regular maintenance and operation procedures at the projects.

g. Continue to keep the grass mowed on the Main dam.

h. Repair all spalled and cracked concrete not previously noted in the recommendations.

i. Remove all trees and brush from the spillway area and downstream toe of the Main dam.

j. Repair the masonry wall on the downstream face of the Main dam. Repairs should bring the crest of the wall level with the crest of the earthen portion of the embankment.

7.4 Alternatives

There are no practical alternatives to the recommendations and remedial measures as noted in Sections 7.2 and 7.3.

APPENDIX A - INSPECTION CHECKLIST

INSPECTION CHECK LIST

PARTY ORGANIZATION

PROJECT Pembroke Cottage Dam

DATE 15 November 1979

TIME 8:00 A.M.

WEATHER Cloudy & Drizzly

W.S. ELEV. * U.S. ____ DN.S

* Unknown

PARTY:

1. C.P. Benziger
2. L.B. Seward
3. ____
4. ____
5. ____
6. ____
7. ____
8. ____
9. ____
10. ____

	PROJECT FEATURE	INSPECTED BY	REMARKS
1.	Dams	Seward & Benziger	
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

INSPECTION CHECK LIST

PROJECT Pembroke Cottage Dam

AREA EVALUATED	CONDITIONS
DAM EMBANKMENT	
Crest Elevation	Estimate El. 60 M.S.L.
Current Pool Elevation	Estimate El. 56 M.S.L.
Maximum Impoundment to Date	Unknown
Surface Cracks	U/S concrete face appeared in good condition.
Pavement Condition	Crest of dam appeared in good condition.
Movement or Settlement of Crest	None
Lateral Movement	None
Vertical Alignment	Crest slightly irregular but not to warrent any concern.
Horizontal Alignment	Appeared true
Condition at Abutment and at Concrete Structures	good - new concrete face
Indications of Movement of Structural Items on Slopes	No indication of any movement
Trespassing on Slopes	None - vertical slopes
Vegitation on Slopes	None
Sloughing or Erosion of Slopes or Abutments	None
Rock Slope Protection - Riprap Failures	None
Unusual Movement or Cracking at or Near Toes	None
Unusual Embankment or Downstream Seepage	None
Piping or Boils	None
Foundation Drainage Features	None found
Toe Drains	None found
Instrumentation System	None existing

INSPECTION CHECK LIST

PROJECT Pembroke Cottage Dam

AREA EVALUATED	CONDITIONS
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	
a. Approach Channel	Appeared to be dug channel
Slope Conditions	Stable
Bottom Conditions	Unknown
Rock Slides or Falls	None
Log Boom	None
Debris	None
Condition of Concrete Lining	Unlined
Drains or Weep Holes	
b. Intake Structure	
Condition of Concrete	Satisfactory
Stop Logs and Slots	Timber stoplogs - leaking

INSPECTION CHECK LIST

PROJECT Pembroke Cottage Dam

AREA EVALUATED	CONDITIONS
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	
General Condition of Concrete	Good
Rust or Staining	
Spalling	
Erosion or Cavitation	
Visible Reinforcing	
Any Seepage or Efflorescence	
Condition at Joints	
Drain Holes	
Channel	
Loose Rock or Trees Overhanging Channel	
Condition of Discharge Channel	Artificial channel parallel to highway. Well vegetated and appeared satisfactory. no logs or debris to impede channel. Protective wall placed against U.S.1 bridge approach fill.

INSPECTION CHECK LIST

PROJECT Pembroke Cottage Dam

AREA EVALUATED	CONDITIONS
OUTLET WORKS - TRANSITION AND CONDUIT	
General Condition of Concrete	Good
Rust or Staining on Concrete	None found
Spalling	None
Erosion or Cavitation	Non-
Cracking	None
Alignment of Monoliths	Appeared to be continuous pour
Alignment of Joints	N/A
Numbering of Monoliths	N/A

INSPECTION CHECK LIST

PROJECT Pembroke Cottage Dam

AREA EVALUATED	CONDITIONS
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	No separate channel - channel is same as intake approach
General Condition	N/A
Loose Rock Overhanging Channel	N/A
Trees Overhanging Channel	None
Floor of Approach Channel	Unknown
b. Weir and Training Walls	None
General Condition of Concrete	
Rust or Staining	
Spalling	
Any Visible Reinforcing	
Any Seepage or Efflorescence	
Drain Holes	
c. Discharge Channel	Same as outlet works channel
General Condition	
Loose Rock Overhanging Channel	
Trees Overhanging Channel	
Floor of Channel	
Other Obstructions	

INSPECTION CHECK LIST

PROJECT Pembroke Cottage Dam

AREA EVALUATED	CONDITIONS
OUTLET WORKS - SERVICE BRIDGE	None
a. Super Structure	
Bearings	
Anchor Bolts	
Bridge Seat	
Longitudinal Members	
Under Side of Deck	
Secondary Bracing	
Deck	
Drainage System	
Railings	
Expansion Joints	
Paint	
b. Amutment & Piers	Abutments are concrete walls
General Condition of Concrete	Good
Alignment of Abutment	Appeared true
Approach to Bridge	None existing
Condition of Seat & Backwall	None existing

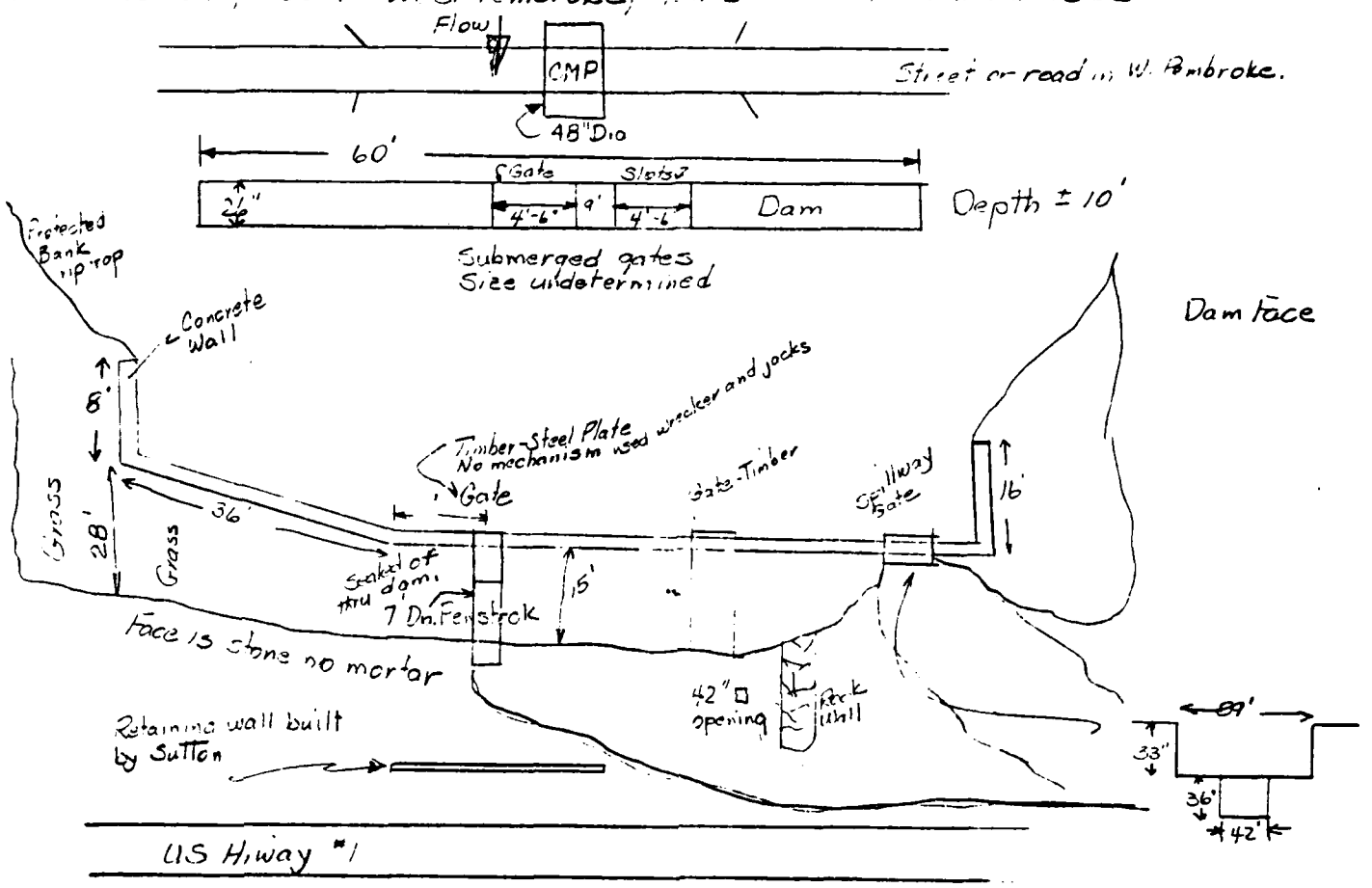
MAIN

Client Corps of Engineers Job No. ____ Sheet ___ of ____

Subject Dam Safety Inspections By L.B.S. Date 11-19-79

Field Notes Ckd. ____ Rev. ____

Pembroke Cottage Dam West Pembroke, Maine Built about 1832



Flood Conditions

Benziger's opinion that present channel is dug or artificial

How much flow would come down right hand channel is difficult to determine Guess 1/5 to under inspection flow conditions.

If flood flow comes down – the street bridge or culvert has limited capacity and flow will tend to go around culvert to the left and eventually back to river channel below the other dam plus down channel to subject dam. by passing on

Should the inspected dam fail or be overtopped – highway would be eroded or washed flow would be increased over dam.

Entire flood down both channels w/ dam failure would result in high hazard downstream at Pembroke. at about or just above tidewater

Concrete upstream wall of dam reported down to bedrock foundation.

INSPECTION CHECK LIST

PARTY ORGANIZATION

PROJECT East Dam

DATE 10 August 1981

TIME 1:00 P.M.

WEATHER Cloudy

W.S. ELEV. 4" U.S. ____ DN.S
over spillway

PARTY:

1. J.E. Giles, Jr., Project Manager
2. Gary D. James, Civil Engineer
3. Turan Otova, Hydrologist
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

	PROJECT FEATURE	INSPECTED BY	REMARKS
1.	All project features were inspected by each of the party members.		
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

INSPECTION CHECK LIST

PROJECT East Dam

AREA EVALUATED	CONDITIONS
DAM EMBANKMENT	
Crest Elevation	
Current Pool Elevation	1' below crest
Maximum Impoundment to Date	Unknown
Surface Cracks	See sketches
Pavement Condition	N/A
Movement or Settlement of Crest	None
Lateral Movement	None
Vertical Alignment	Good (see sketch)
Horizontal Alignment	Good
Condition at Abutment and at Concrete Structures	
Indications of Movement of Structural Items on Slopes	None
Trespassing on Slopes	
Vegetation on Slopes	N/A
Sloughing or Erosion of Slopes or Abutments	
Rock Slope Protection - Riprap Failures	N/A
Unusual Movement or Cracking at or near Toes	See sketch
Unusual Embankment or Downstream Seepage	See sketch
Piping or Boils	None
Foundation Drainage Features	N/A
Toe Drains	N/A
Instrumentation System	N/A

INSPECTION CHECK LIST

PROJECT East Dam

AREA EVALUATED	CONDITIONS
OUTLET WORKS - CONTROL TOWER	
a. Concrete and Structural	
General Condition	Poor
Condition of Joints	Poor (base slab under wingwall)
Spalling	Min.
Visible Reinforcing	None visible
Rusting or Staining of Concrete	None visible
Any Seepage or Efflorescence	See sketch
Joint Alignment	See sketch
Unusual Seepage or Leaks in Gate Chamber	See sketch
Cracks	See sketch
Rusting or Corrosion of Steel	None
b. Mechanical and Electrical	
Air vents	N/A
Float Wells	N/A
Crane Hoist	N/A
Elevator	N/A
Hydraulic System	N/A
Service Gates	Good condition/visibly maintained
Emergency Gates	Unknown
Lightning Protection System	N/A
Emergency Power System	N/A
Wiring and Lighting System in Gate Chamber	N/A

INSPECTION CHECK LIST

PROJECT East Dam

AREA EVALUATED	CONDITIONS
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	
a. Approach Channel	
Slope Conditions	Good - no visible rock slides or slope sloughes
Bottom Conditions	Good (gravel)
Rock Slides or Falls	None
Log Boom	N/A
Debris	None
Condition of Concrete Lining	N/A
Drains or Weep Holes	N/A
b. Intake Structure	
Condition of Concrete	See sketch
Stop Logs and S-ots	Good condition - Stop logs not seen at time of inspection.

INSPECTION CHECK LIST

PROJECT East Dam

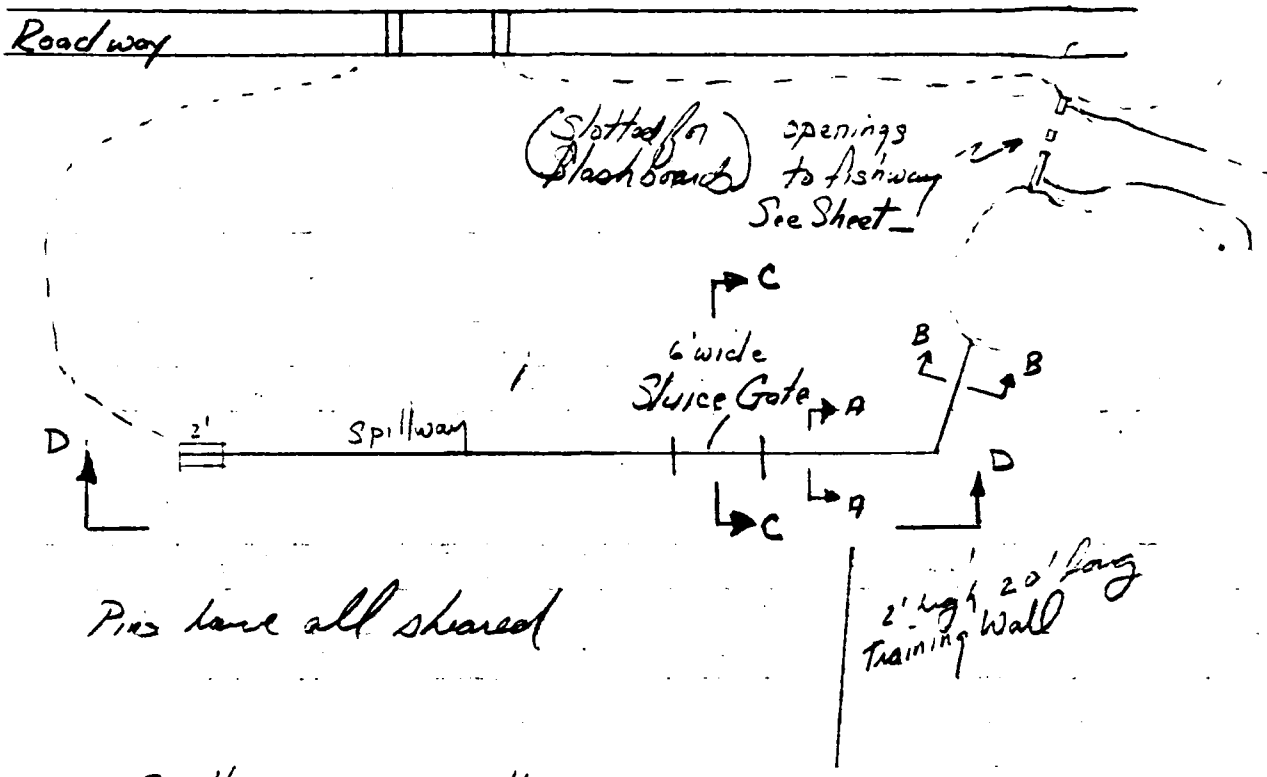
AREA EVALUATED	CONDITIONS
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	
General Condition	Good
Loose Rock Overhanging Channel	N/A
Trees Overhanging Channel	None
Floor of Approach Channel	Gravel - good
b. Weir and Training Walls	N/A
c. Discharge Channel	
General Condition	Excellent
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	Slight
Floor of Channel	Bedrock
Other Obstructions	Training wall - see sketch

MAIN

Client Corps of Eng. Job No. 1345-072 Sheet 1 of 11

Subject Pembroke Cottage Dam on Pennamaquan River By GDS Date

Ckd. Rev.



Pins have all sheared

7" Spilling over spillway @ time of inspection

Spillway is only 12" of concrete on bedrock & 7' plunge

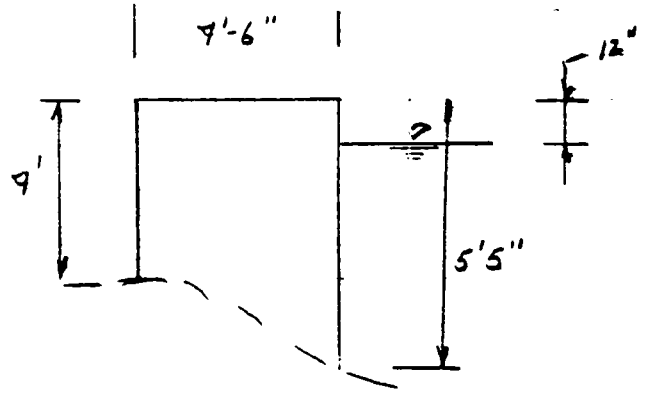
Rock outcrop only breaking the surface of the water on the downstream side of the spillway just for all but a 7' section in center of spillway

MAIN

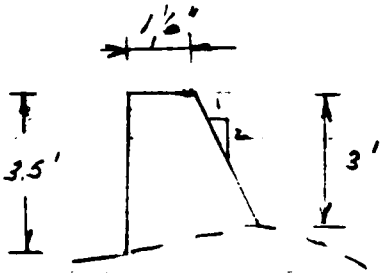
Client Corps of Eng Job No. 1345-012 Sheet 2 of 11

Subject Pembroke Cottage By GDJ Date

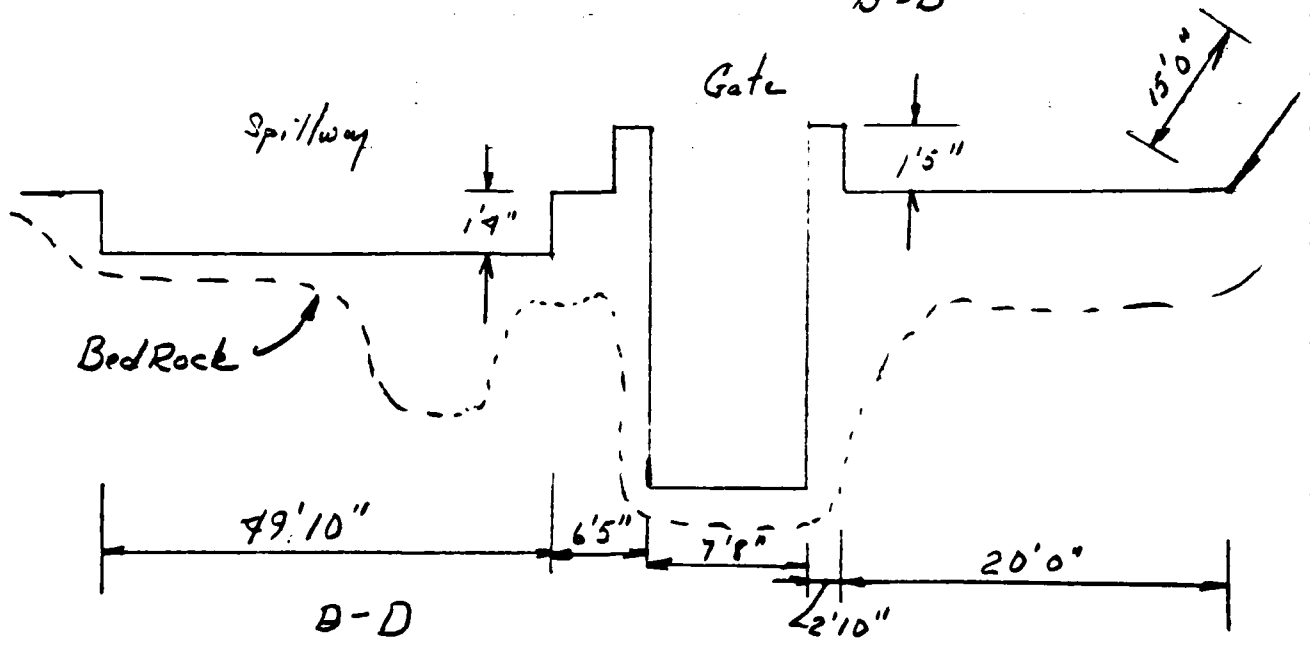
Chkd. Rev.



A-A



B-B



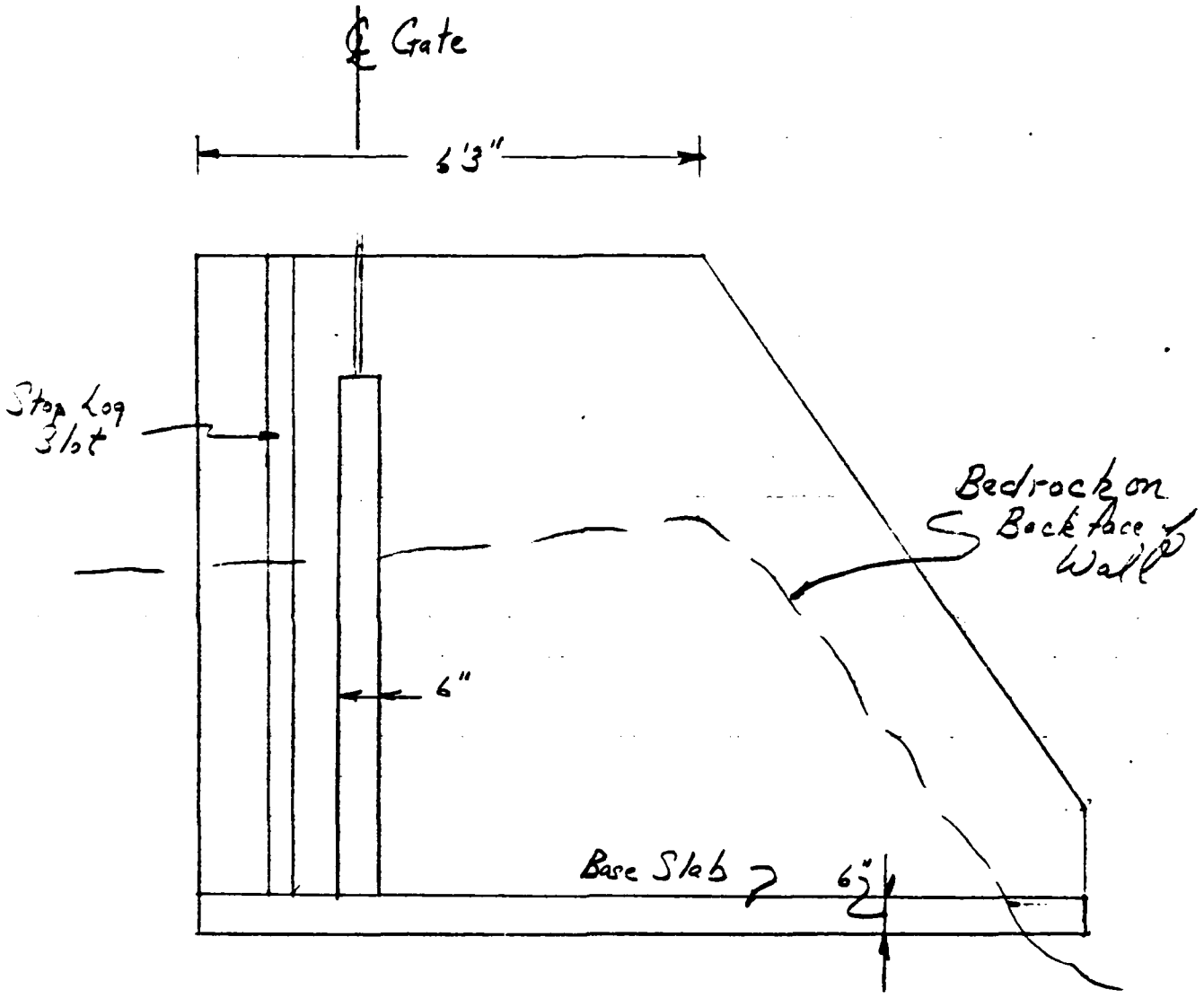
D-D

MAIN

Client Corps of Engineers Job No. 1345-072 Sheet 3 of 11

Subject Pembroke Cottage By GDJ Date

Ckd. Rev.



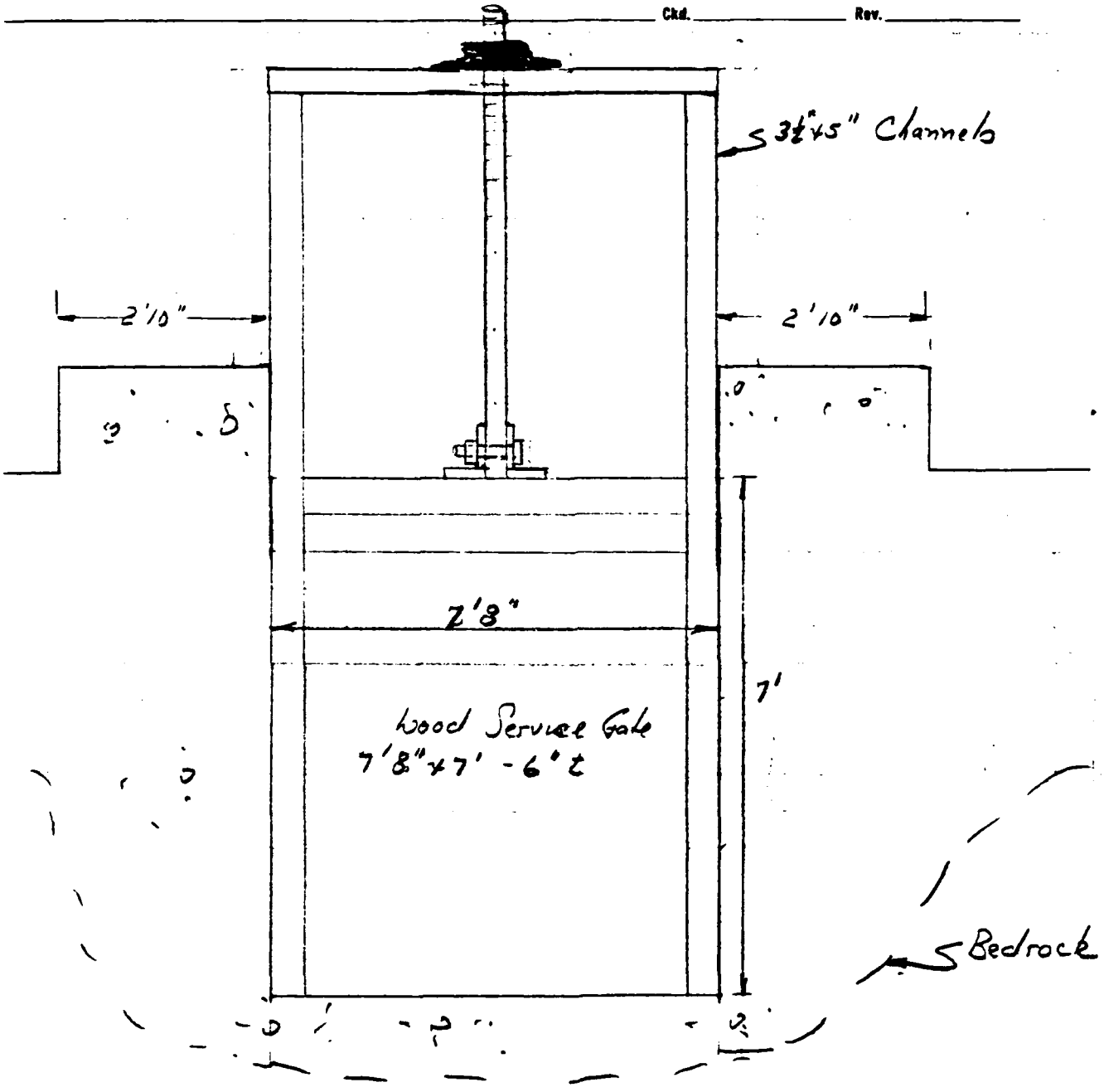
C-C.

MAIN

Client Corps of Eng. Job No. 1345-072 Sheet 4 of 11

Subject Pembroke By GDJ Date

Ckd. Rev.

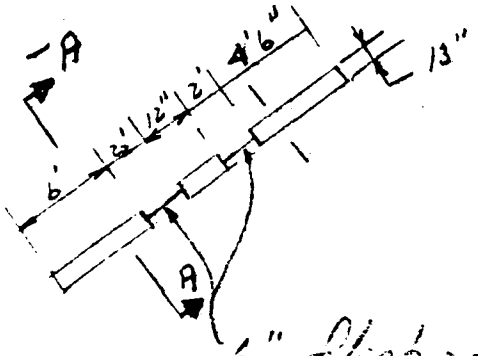


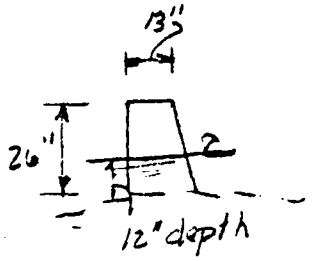
MAIN

Client Corps of Eng. Job No. 1345-072 Sheet 5 of 11

Subject Pembroke By GDJ Date

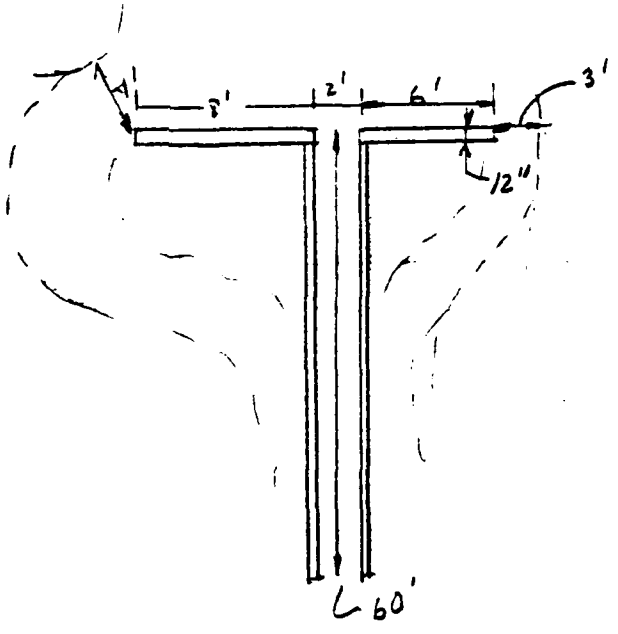
Ckd. Rev.





A-A

6" Aluminum Cap at End of Injection



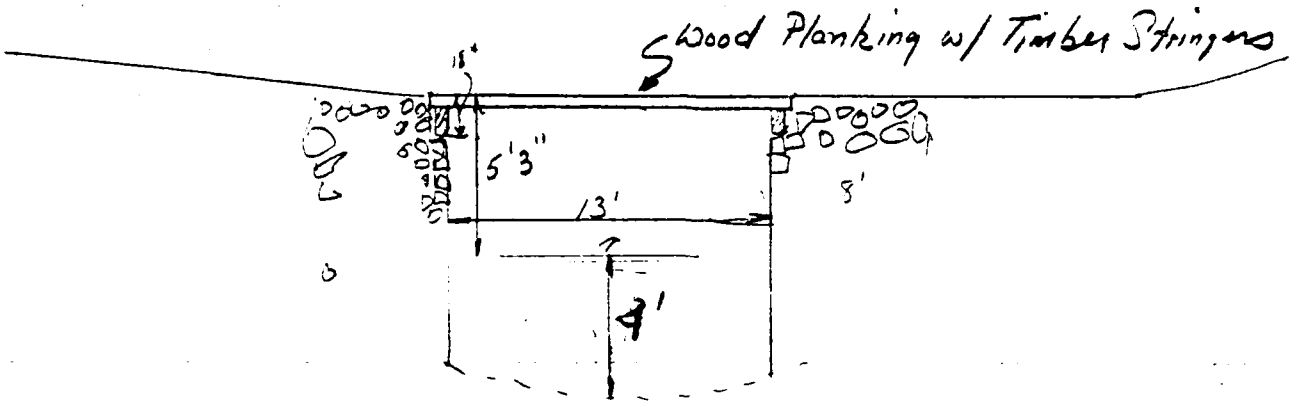
MAIN

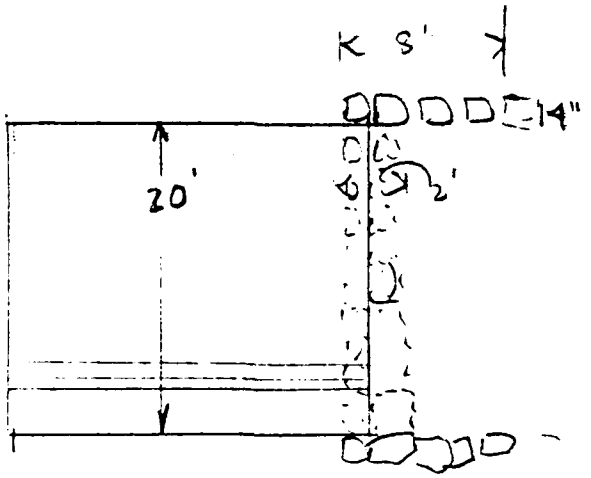
Client Corps of Engineers Job No. 1345-072 Sheet 6 of 11

Subject Pembroke By GDJ Date

Ckd. Rev.

Roadway Opening



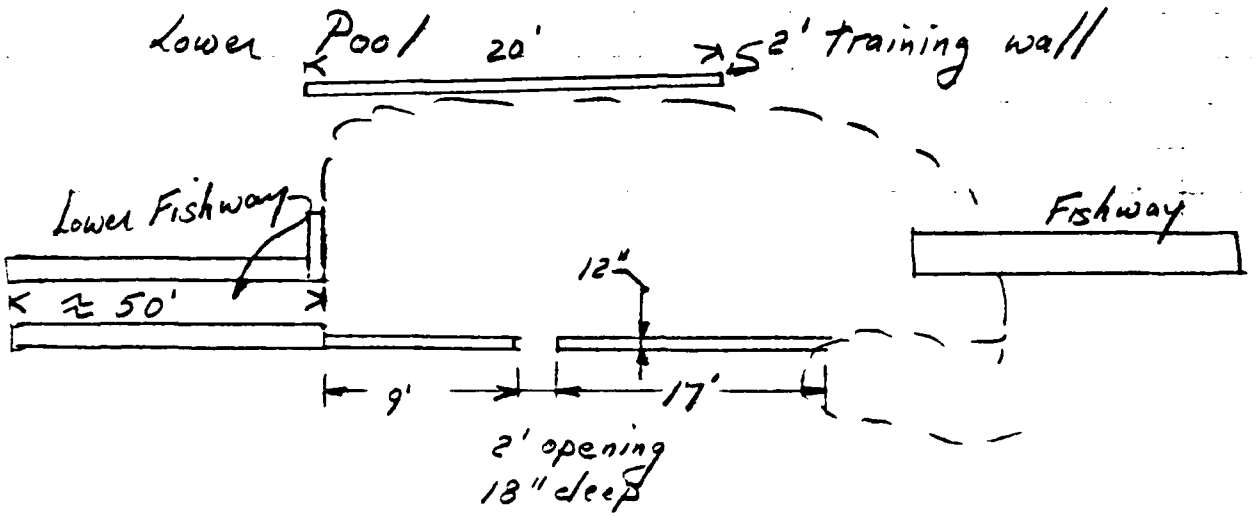


MAIN

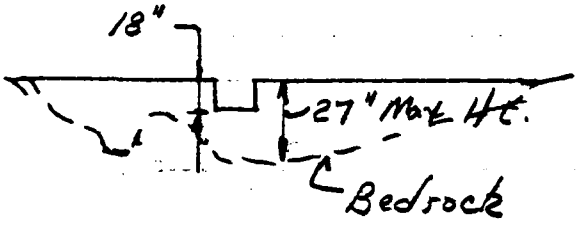
Client Corps of Engineers Job No. 1345-072 Sheet 7 of 11

Subject Pembroke Cottage Dam By GDJ Date

Ckd. Rev.



12" flash boards in place @ time of inspection



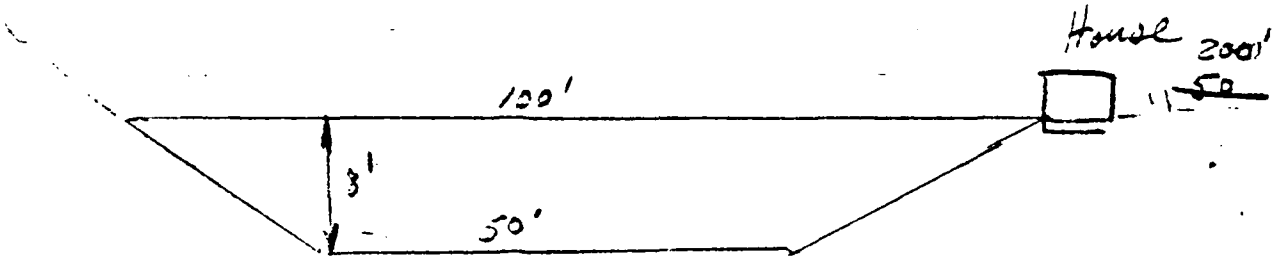
MAIN

Client Corps of Eng. Job No. 1345-072 Sheet 8 of 11

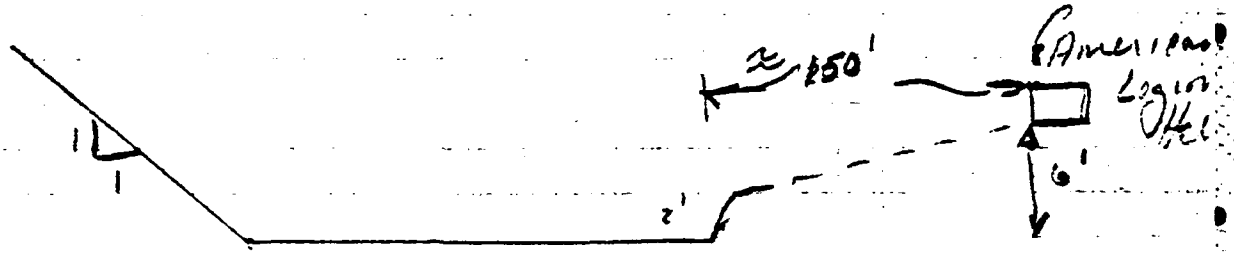
Subject Pembroke By GDJ Date

Ckd. Rev.

Downstream Channel



.30 miles D/S



.4 mile D.S.

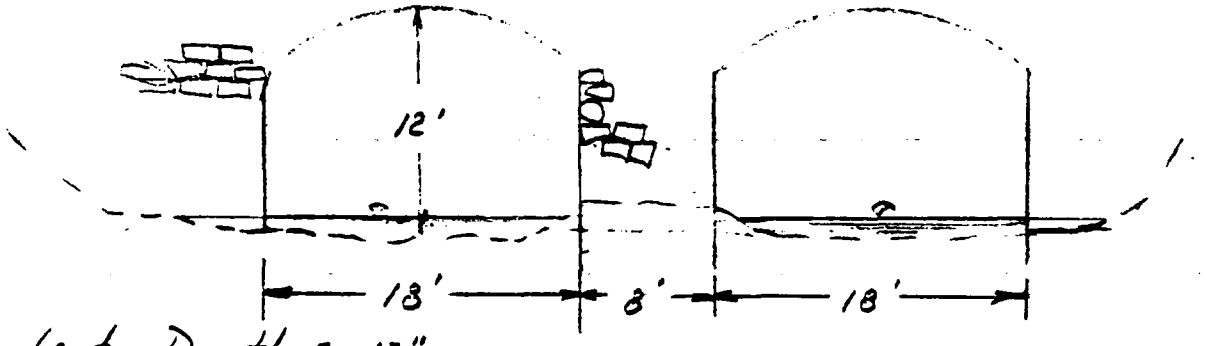
MAIN

Client Corps of Eng. Job No. 1345-072 Sheet 9 of 11

Subject Pembroke By GDJ Date

Ckd. Rev.

.45 Miles D/S



Water Depth ± 12"

Double Arch Masonry Bridge

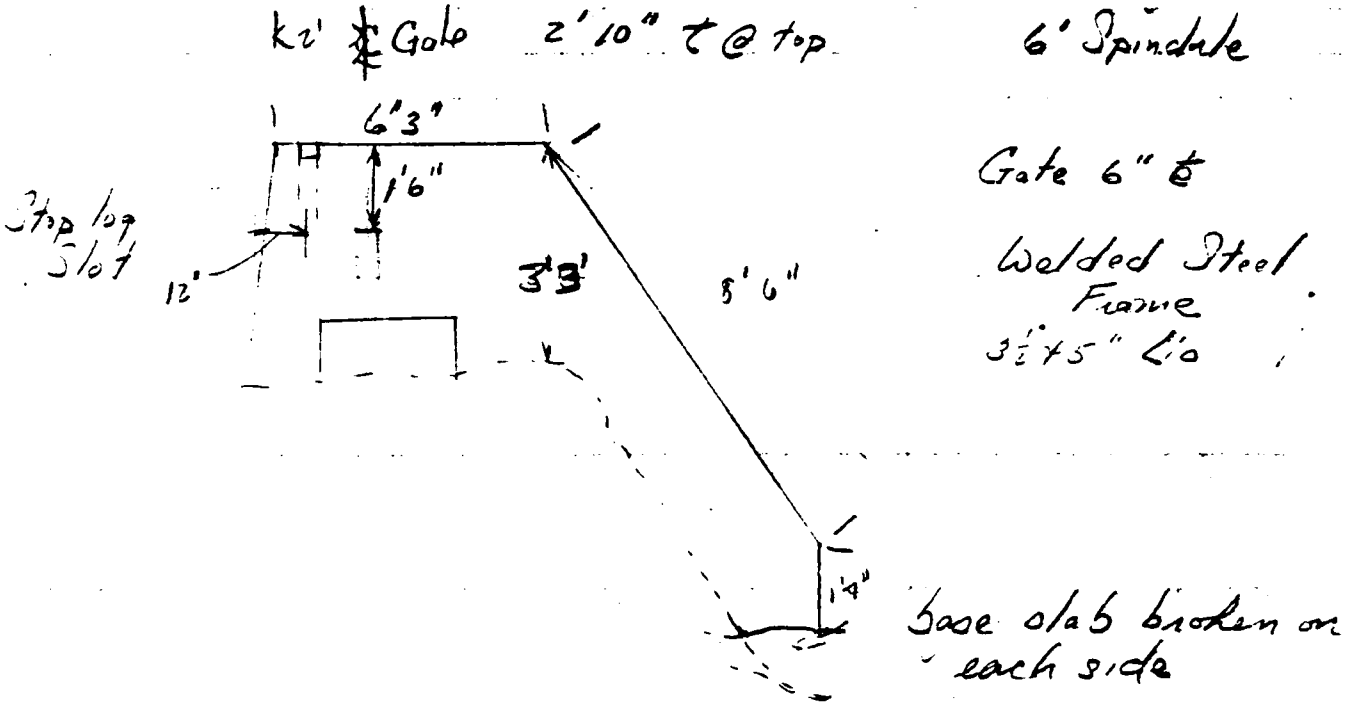
Tidal zone begins ± 100 yds downstream of this bridge

MAIN

Client Corps of Engineers Job No. 1345-07E Sheet 10 of 11

Subject Field Notes East Dam By GDS Date

Ckd. Rev.



Extensive Cracks on Spillway Side wall water seen seeping out @ base just downstream of gate / Base slab has separated from wall bedrock observed on outer face of each wall but not on inner face

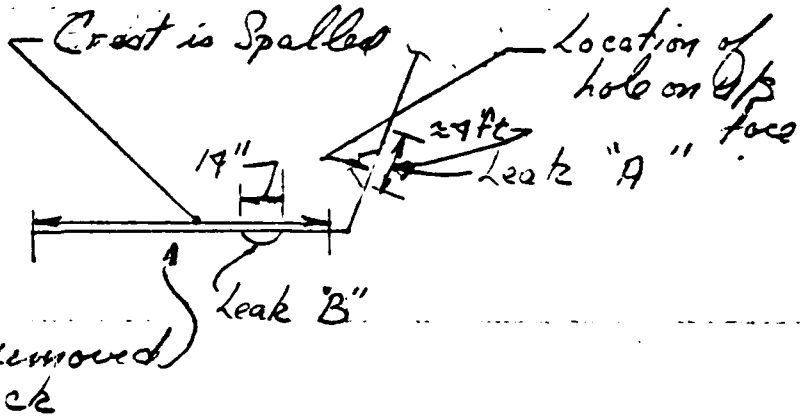
Gate was leaking @ base

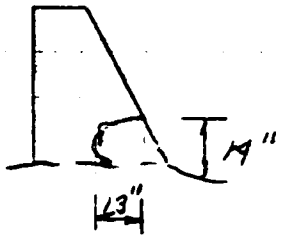
MAIN

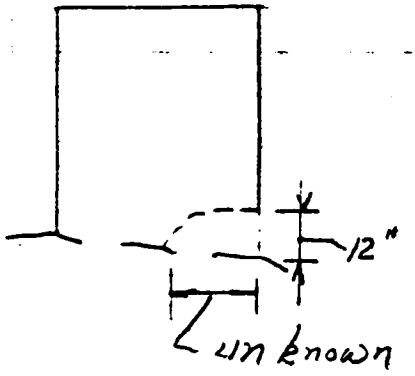
Client Corps of Engineers Job No. 1345-072 Sheet 11 of 11

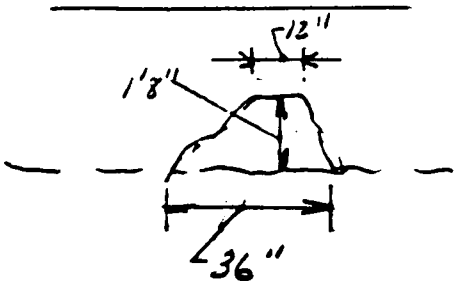
Subject Field Notes East Dam By GDL Date

Chd. Rev.

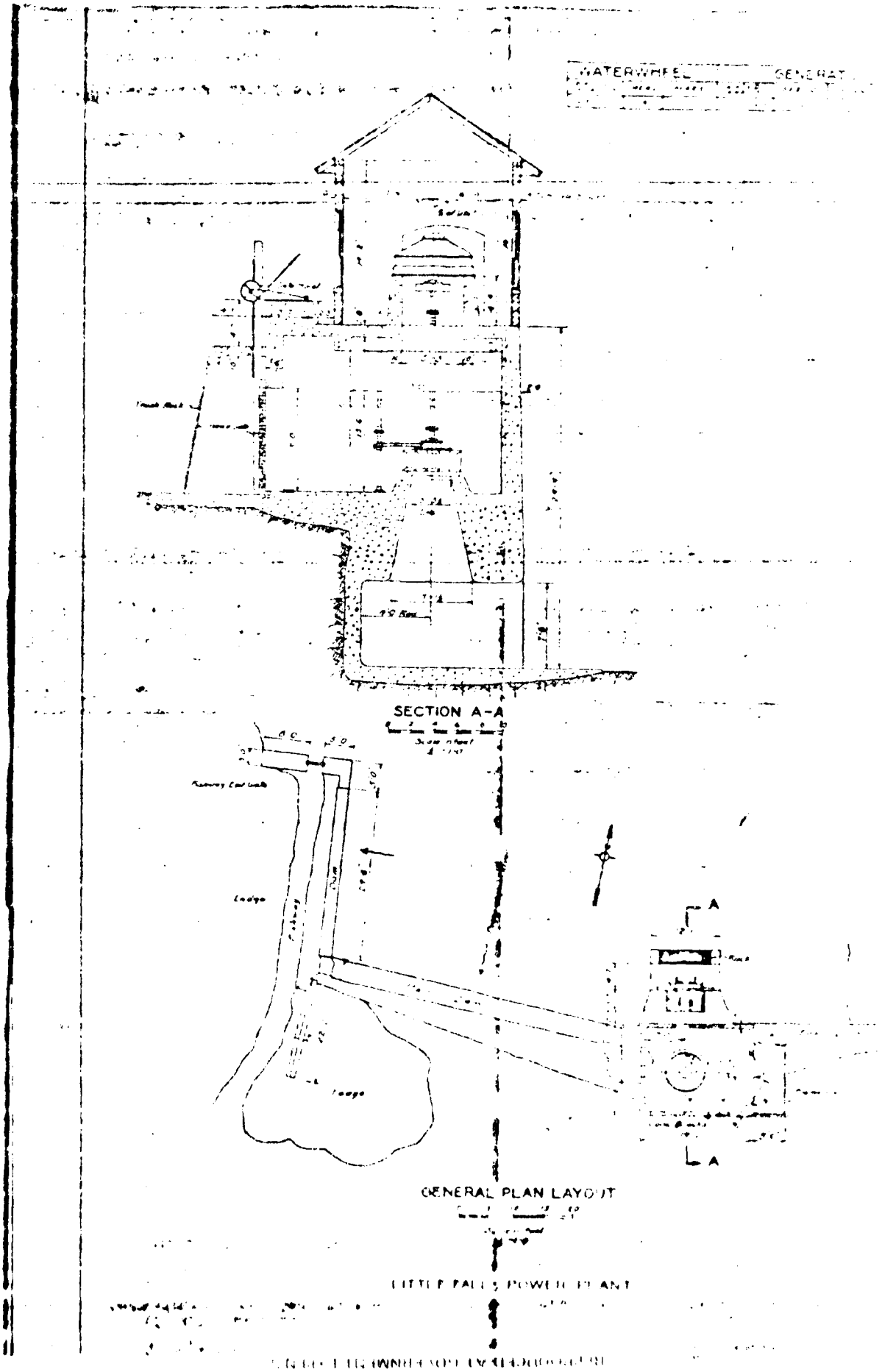


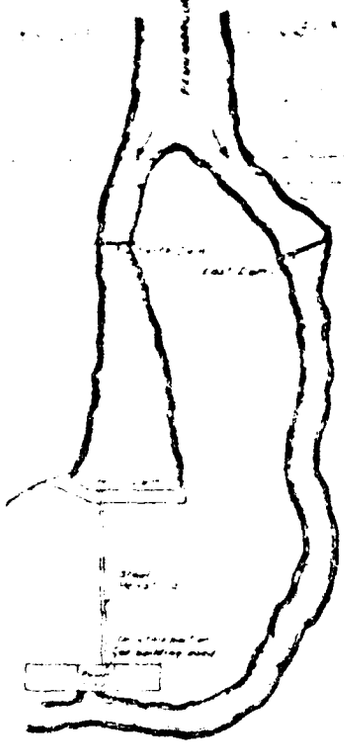






APPENDIX B - ENGINEERING DATA

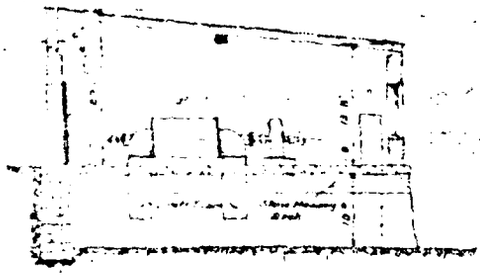

WATERWHEEL
GENERAT
SECTION A-A
A
A
GENERAL PLAN LAYOUT
LITTLE FALLS POWER PLANT



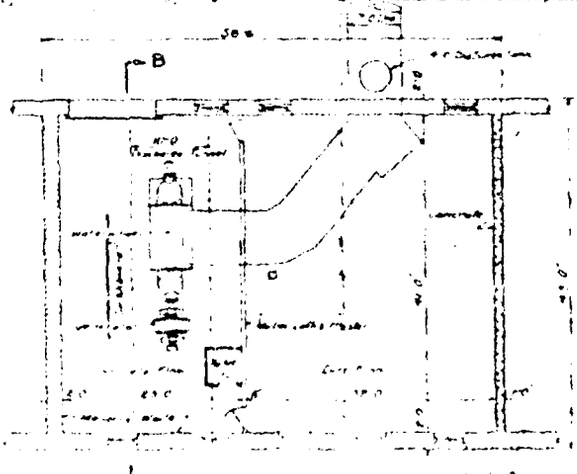
GENERAL PLAN OF DAMS & POWER PLANT

Not to scale

WATERWHEEL	GENERATOR



SECTION B-B

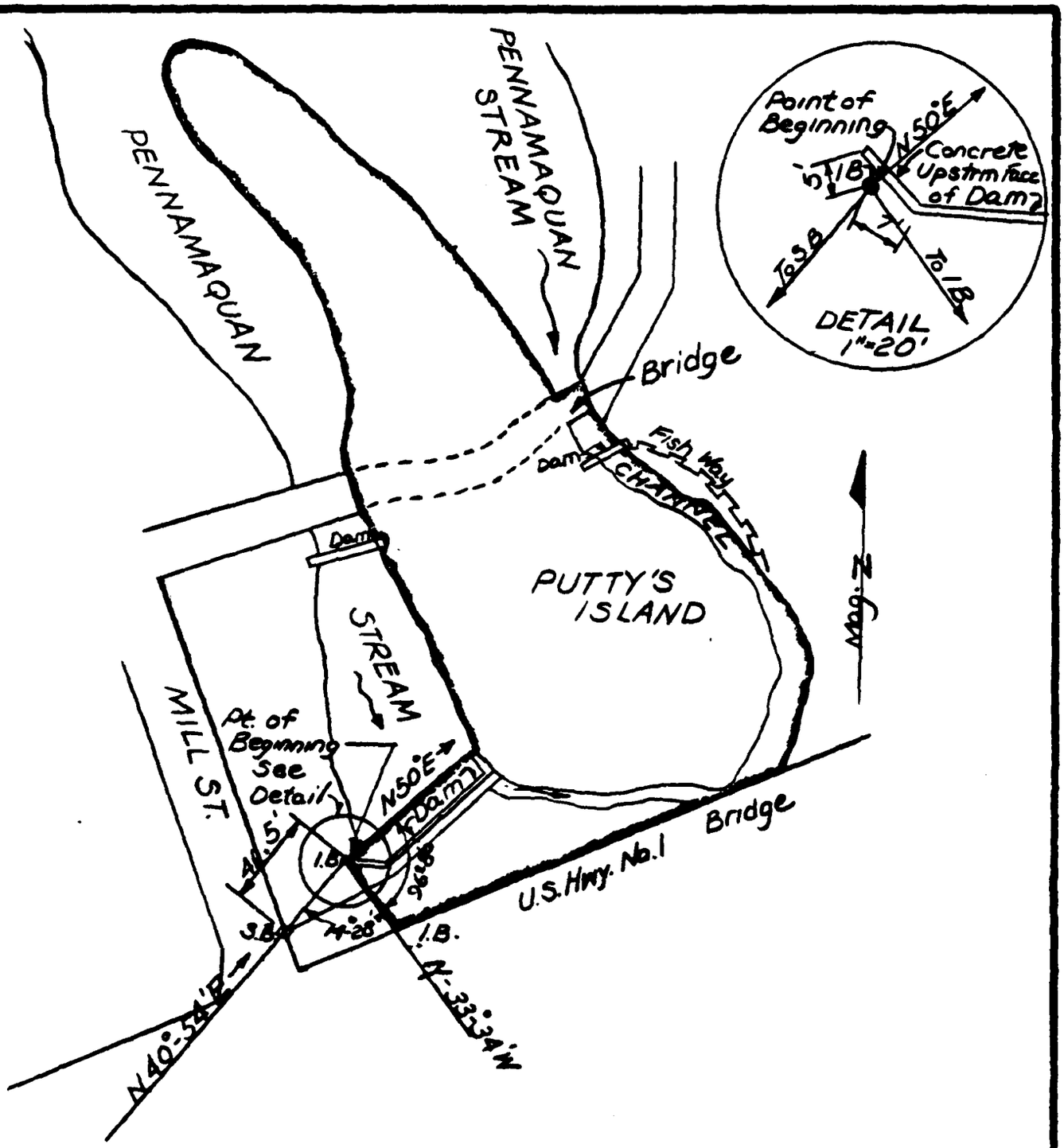


PLAN

IRON WORKS POWER PLANT

BIG CREEK POWER & ELECTRIC CO.

GENERAL PLAN



Reproduced From Bangor Hydro-Electric Co. Plan of Land Conveyed May 6, 1957

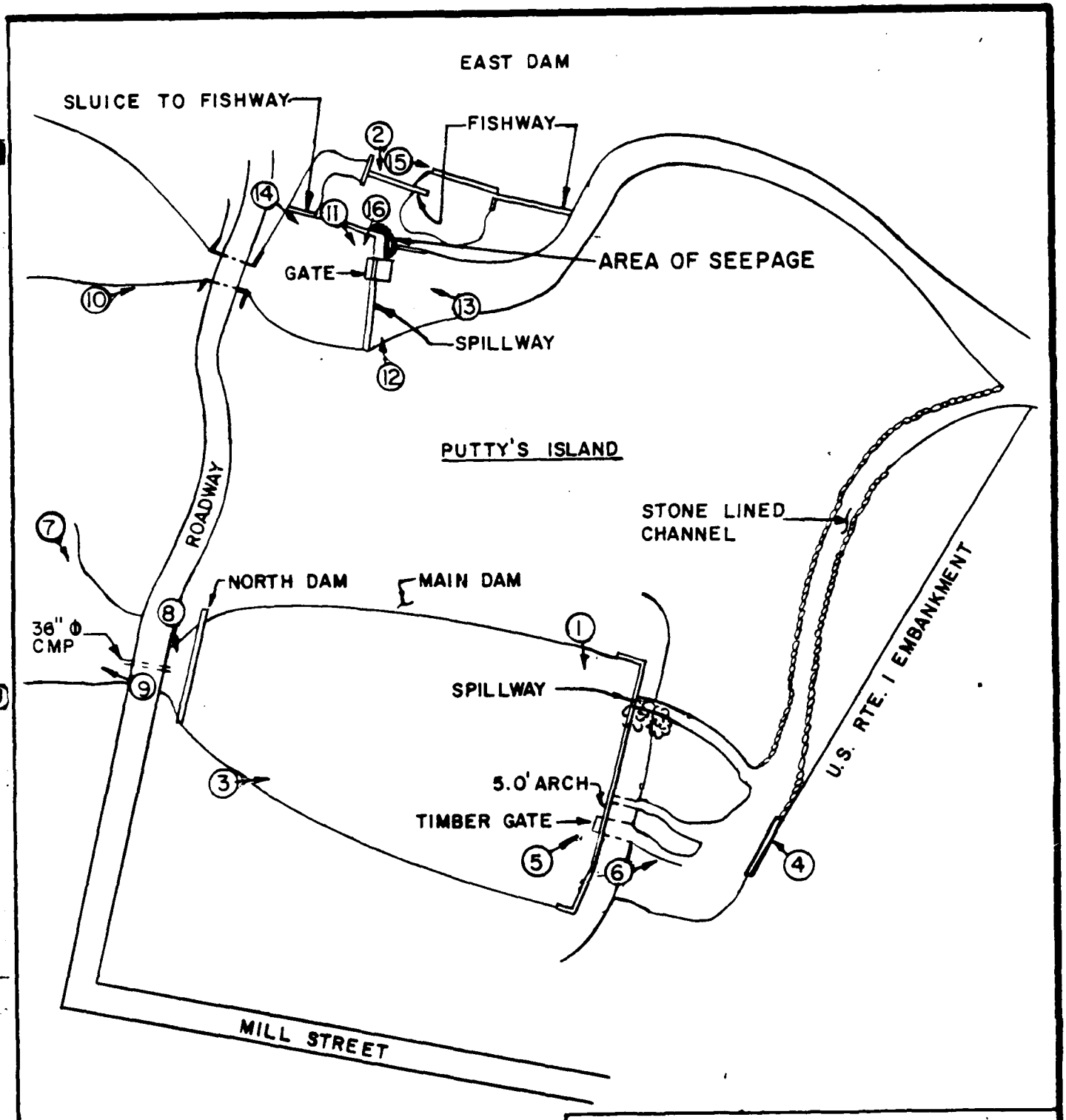
Approx Scale 1"=200'

MAIN

DATE

CLIENT JOB PLATE

APPENDIX C - PHOTOGRAPHS



LEGEND:

(1) PHOTO LOCATION

PEMBROKE COTTAGE
PHOTO LOCATION

U.S. ARMY CORPS OF ENGINEERS
PHASE I INSPECTION PROGRAM

DATE SEPT 1981

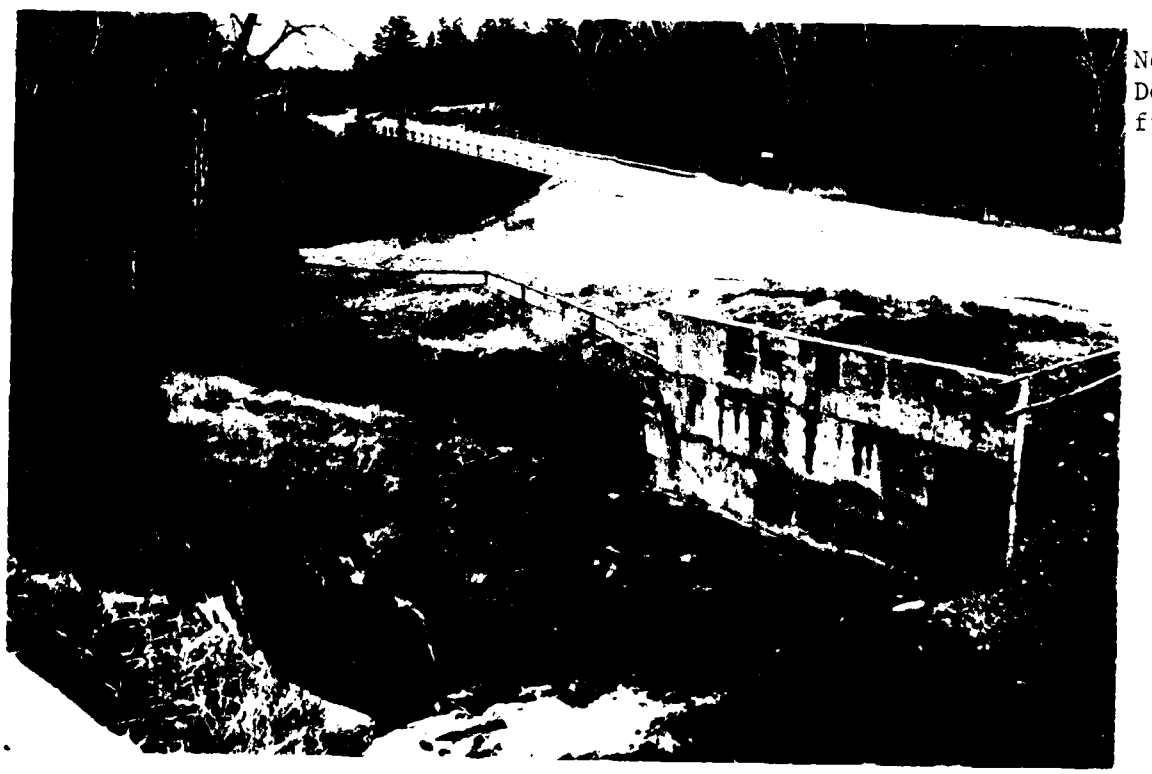
MAIN

CLIENT	JOB	PLATE
1345	72	

No. 3
Main Dam from
Reservoir Area

No. 4
Downstream
Slope of Main
Dam

No. 5
Gate Structure
for Timber Gate
At Main Dam

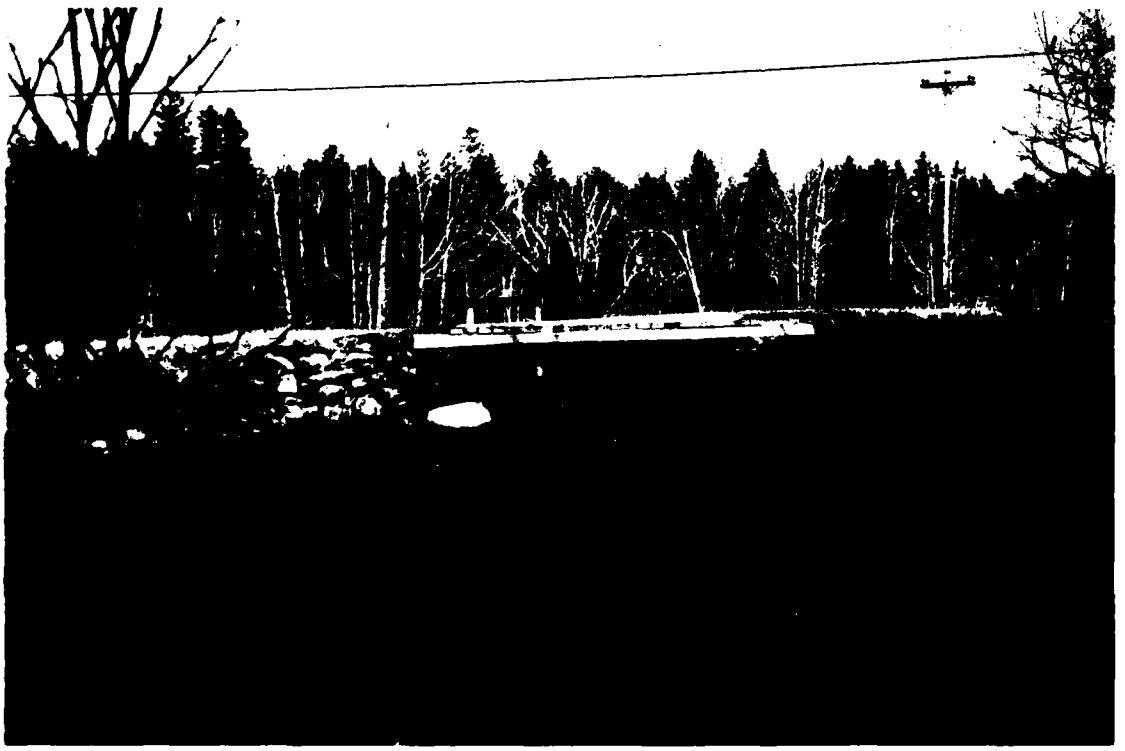


No. 6
Downstream Channel
from Main Dam

No. 7
View from Upstream of 36"Ø CMP at roadway

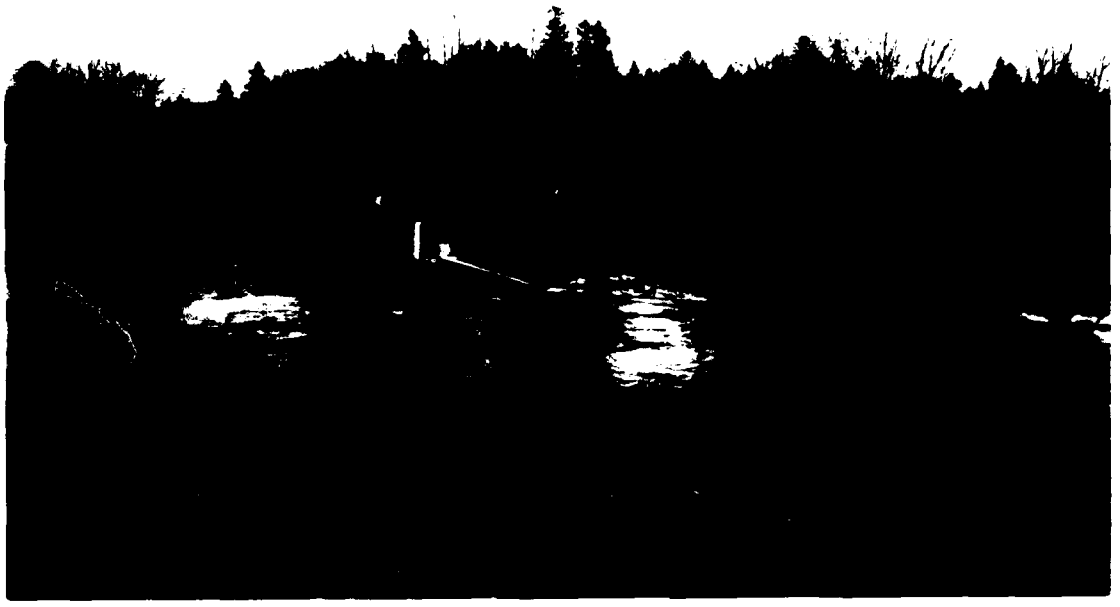
No. 8
North Dam from Roadway

No. 9
View of Reservoir Area from Roadway at North Dam



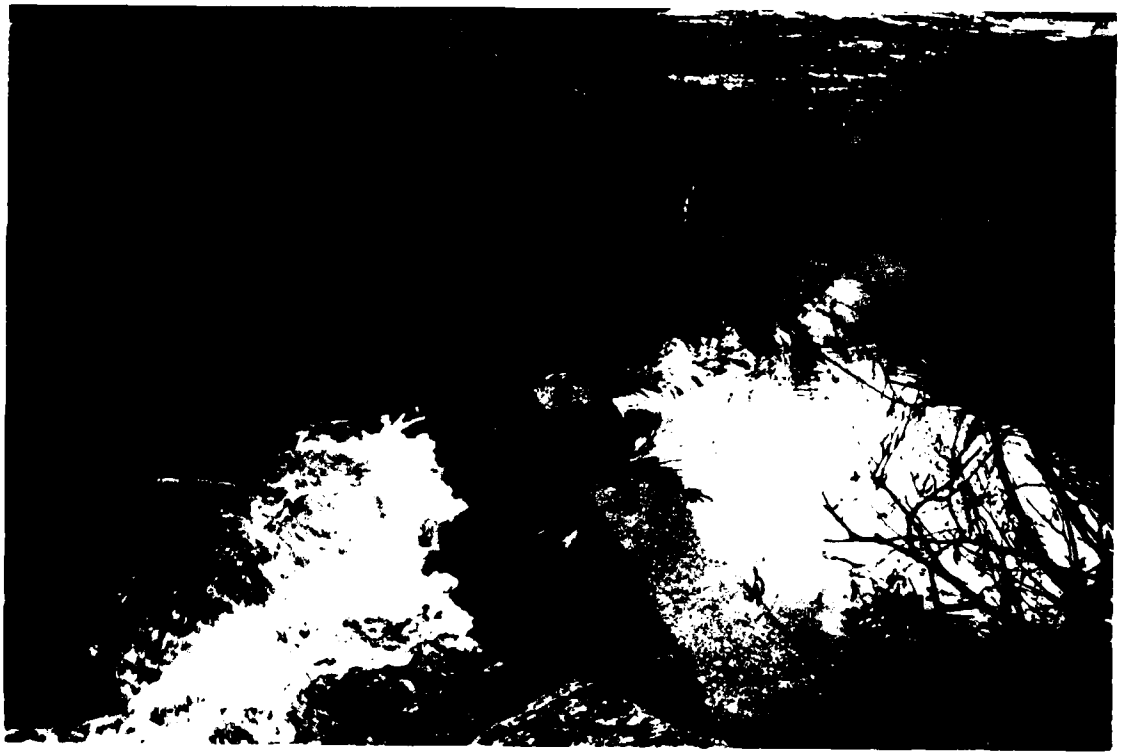
No. 10
Bridge above East Dam from Reservoir Area

No. 11
East Dam from
Right Abutment
Area



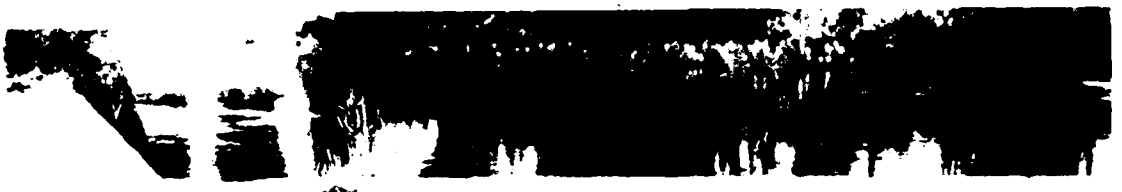
No. 12
Spillway from
Right Abutment

No. 13
Gate Structure
from Downstream



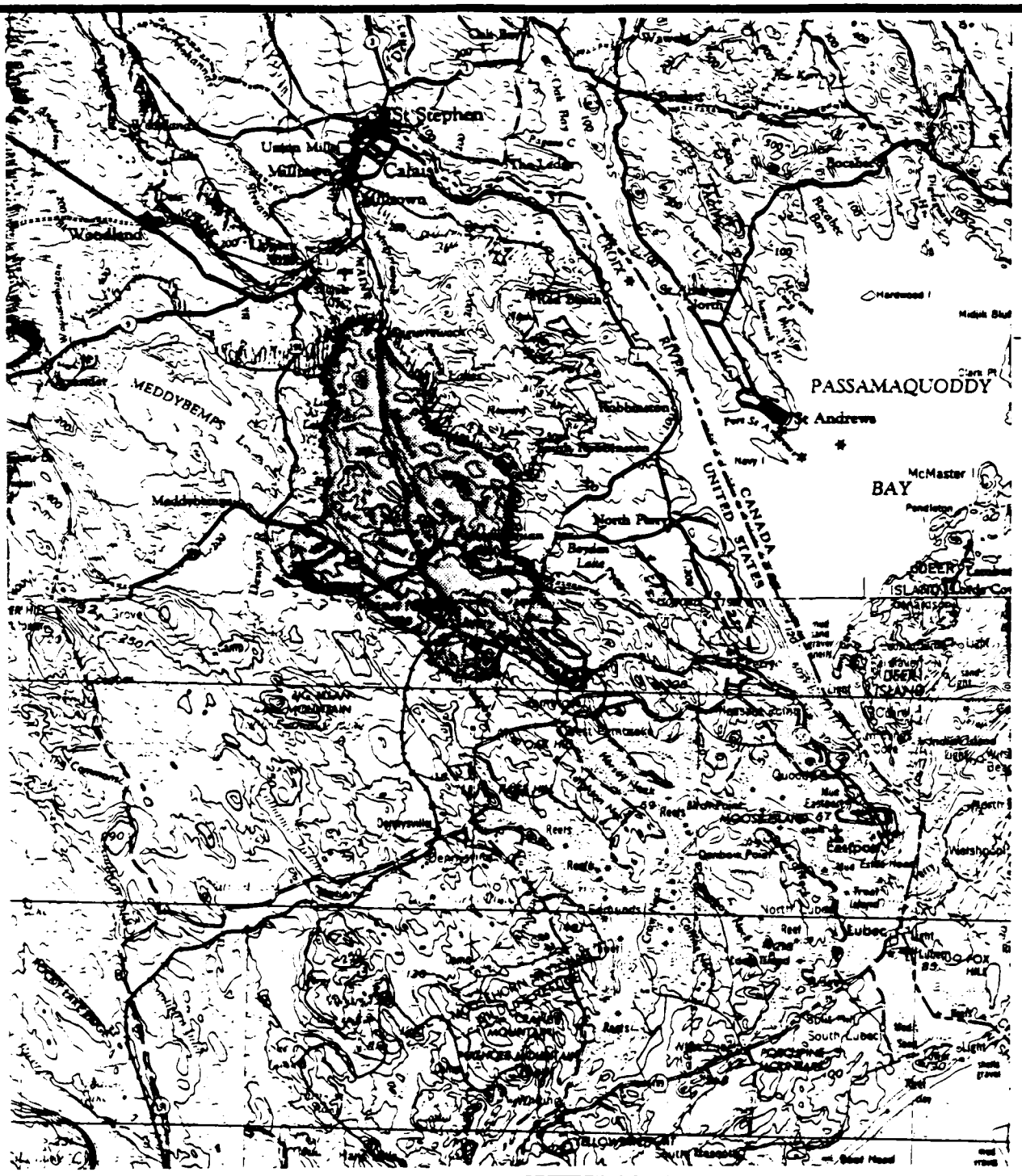
No. 14
Sluiceway Openings
to Fishway

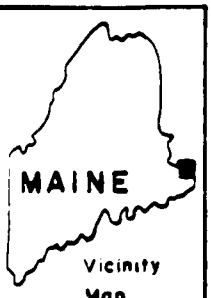
No. 15
Lower Fishway
Pool



No. 16
Crack in East
Dam at Left
Abutment Wall

APPENDIX D - HYDROLOGIC AND HYDRAULIC COMPUTATIONS





FROM U.S.G.S. 2° QUADRANGLES., EASTPORT, ME. U.S., N.S., N.B. CANADA & FREDRICTON, N.B., CANADA, MAINE, U.S.

1 0 1

SCALE: 1" = 4 MILES

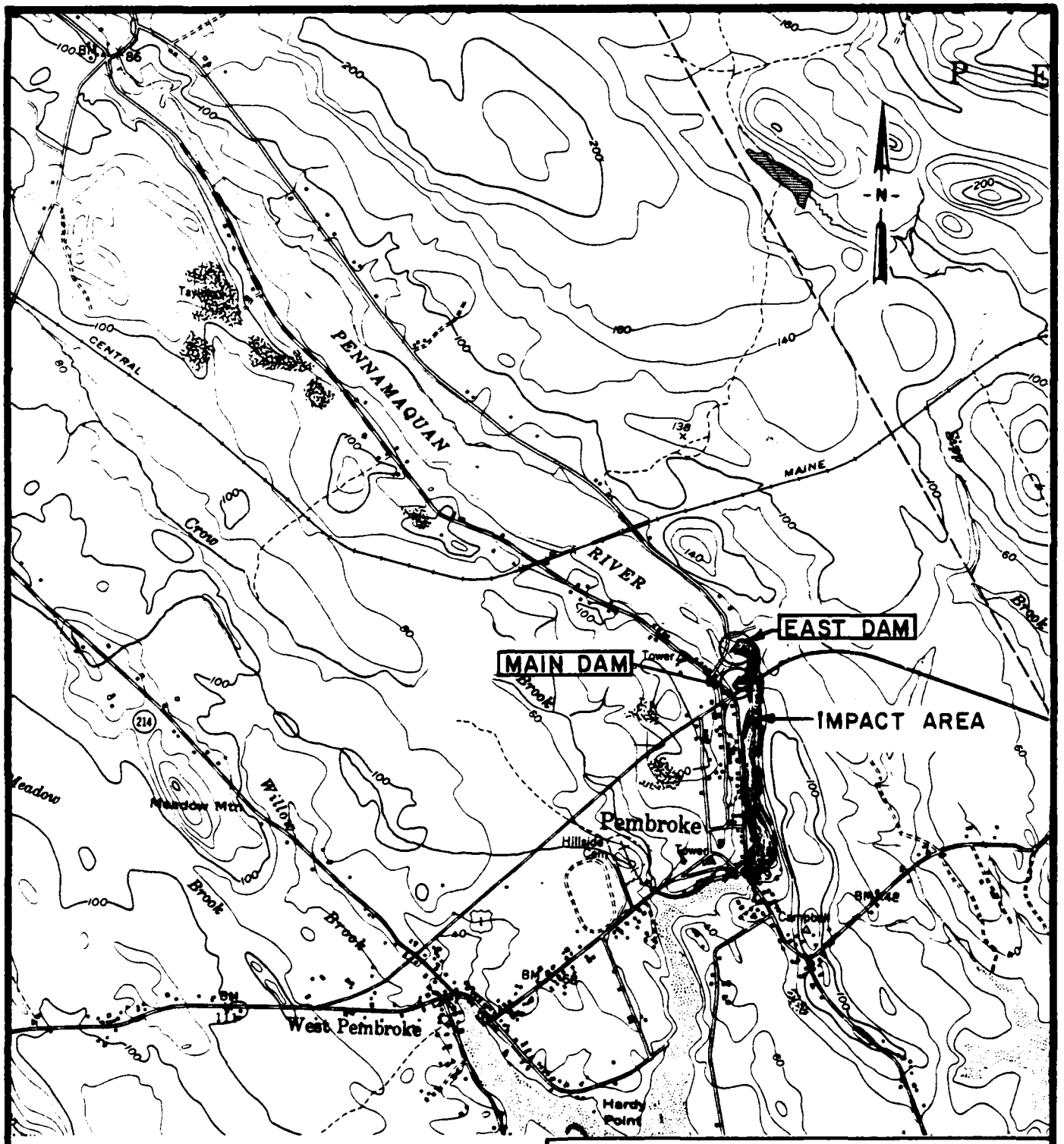
DRAINAGE AREA MAP PEMBROKE COTTAGE MAIN DAM & EAST DAM

U.S. ARMY CORPS OF ENGINEERS
PHASE I INSPECTION PROGRAM

MAIN

DATE SEPT. 1981

CLIENT 100 PLATE
1345 72



MAINE

Vicinity Map

FROM U.S.G.S. 7.5 MIN. QUADRANGLE MAP PEMBROKE, MAINE.

2000 0 2000

SCALE: 1" = 2000'

PEMBROKE COTTAGE MAIN DAM & EAST DAM LOCATION MAP

U.S. ARMY CORPS OF ENGINEERS
PHASE I INSPECTION PROGRAM

MAIN

DATE SEPT. 1981

CLIENT	JOB	PLATE
1345		72

MAIN

Client CORP OF ENGINEERS Job No. 134-072-04 Sheet 1 of 14

Subject CEMBRIDGE - COTTAGE FARM By T. STOVA Date 09-29-81

HYDROLOGY - HYDRAULICS Ckd. Rev.

DRAINAGE AREA = 39.0 sq. mi.

For coastal flat plains PMF curves (Corps of Engineers Guidelines, March 1978), yield 540 CFS / sq.mi. peak discharge.

The total peak discharge = 39 × 540 = 21060 CFS. The Guideline Curves are derived for 19" runoff. In this part of New England, Maine, Depth-Area-Duration curves show a 13" of runoff and this is confirmed by Corps of Engineers.

Then, the test flood is assumed to be equal to PM- which is,

$$Q_{test} = 21060 \times \frac{13}{19} = 14410 \text{ CFS.}$$

The secondary dam is assumed to be functioning as emergency spillway. The rating curve is illustrated in 9 page. The principal spillway is the spillway of the main dam. The rating table is tabulated in page 7 The AREA-CAPACITY curves are estimated from USGS

scale topographic maps and by using logarithmic curve fitting procedure (page 3 & 4). The Area-Capacity curves are presended in page 5.

The effects of surcharge storage on maximum probable discharges are estimated according to Corps of Engineers procedure presended in the previous pages. As it can be seen from page 10, the test flood rises the reservoir level 60.35 - 57.0 = 3.35 ft. for the volume = 13".

Results:

Averaged Discharge = 1500 CFS (From Rating Curve)

Water Surface Elev. = 60.35 FT

Surcharge Height = 3.35 FT

Crest Elevations:

- Main Dam = 61'.2"
- Secondary Dam = 58'.5"

Volume at Main Dam Crest Elev. = 14700 AC-FT

Volume at Max. Water Surface Elv. = 13 800 AC-FT

The Main Dam will not be overtopped.

MAIN

Client CORPS OF ENGINEERS Job No. 1345-072 Sheet 3 of 14

Subject PEMBROKE - COTTAGE DAM By T OTOVA Date 01-FX-1981

HYDROLOGY - HYDRAULICS Ckd. Rev.

CORPS OF ENGINEERS

PEMBROKE - COTTAGE DAM

A R E A - C U R V E

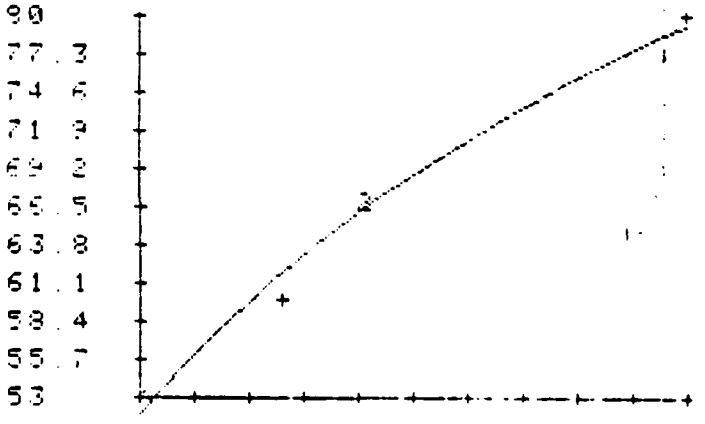
I	X(I)	Y(I)
1	10324.0000	53.0000
2	14767.0000	60.0000
3	27312.0000	80.0000

ADV LOG REG CODE 2

SOURCE	DF	SS	MS	F
TOTAL	2	392.7		
REG	1	387.1	387.1	69.0
RESID	1	5.6	5.6	

R SQUARE = 0.986

YHAT= -209.508+ 28.272LOG X



XMIN=10324 XMAX=1698.8

Client CORPS OF ENGINEERS Job No. 1365-077 Sheet 4 of 14

Subject PEMBROKE - COTTAGE DAM By T. OTUYA Date 07-IX-1981

HYDROLOGY - HYDRAULICS Ckd. Rev.

CORPS OF ENGINEERS

PEMBROKE - COTTAGE RESERVOIR
C A P A C I T Y - C U R V E

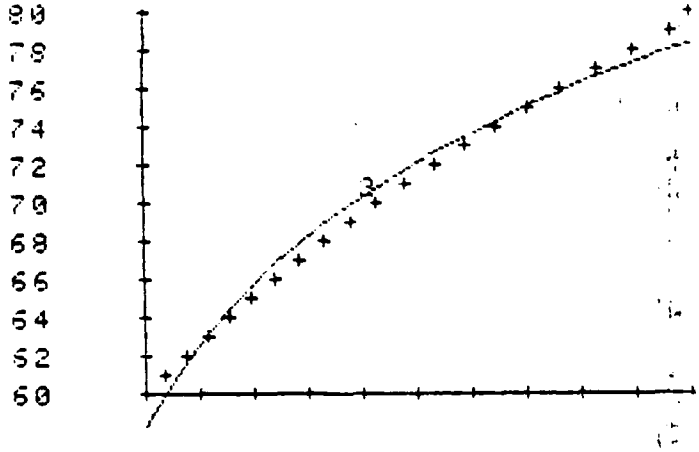
I	X(I)	Y(I)
1	94071.0300	60.0000
2	108629.0100	61.0000
3	123711.1400	62.0000
4	139336.2800	63.0000
5	155523.9800	64.0000
6	172294.4900	65.0000
7	189668.8100	66.0000
8	207668.6700	67.0000
9	226316.5800	68.0000
10	245635.8900	69.0000
11	265650.7700	70.0000
12	286386.2500	71.0000
13	307868.2900	72.0000
14	330123.7600	73.0000
15	353180.5100	74.0000
16	377067.3900	75.0000
17	401814.2800	76.0000
18	427452.1500	77.0000
19	454013.0800	78.0000
20	481530.3000	79.0000
21	495532.2100	80.0000

ROW: LOG REG CODE 2

SOURCE/DF	SS	MS	F
TOTAL 20	770.0		
REG 1	756.4	756.4	999.9
RESID 19	13.6	0.7	

R SQUARE = 0.982

YHAT= -80.279+ 12.097LOG X



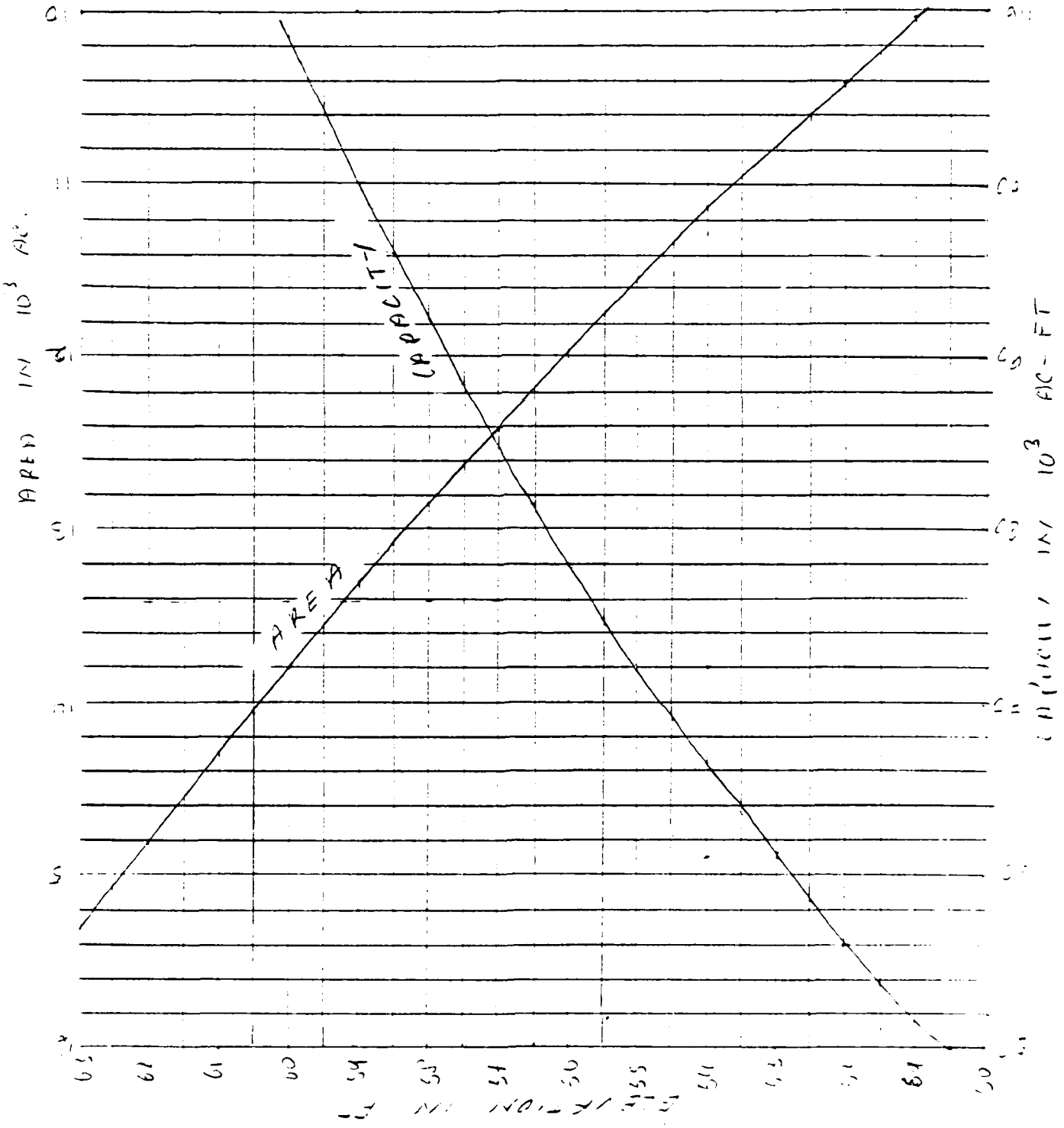
XMIN=94071.03 TICS=40146.118

MAIN

Client CORPS OF ENGINEERS Job No. 1345-072 Sheet 5 of 4

Subject PEMBROKE - COTTAGE DAM By T.O'D/A Date 25-IX-83

HYDROLOGY - HYDRAULICS Ckd. Rev.

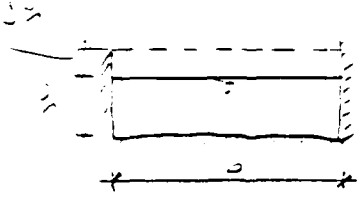


MAIN

Client CORPS OF ENGINEERS Job No. 345-032 Sheet 6 of 141
Subject PEMBROKE – COTTAGE DAM By T. TJIA Date 12-20-2
HYDROLOGY – HYDRAULICS Ckd. Rev.

Rating Table of the bridge upstream from the second Dam

$$Q = \frac{1.49 \times A \times R^{2/3} \times S^{1/2}}{n}$$



$$A = b \times (h + \frac{\Delta h}{2}) \qquad R = \frac{A}{W} \qquad S = \frac{\Delta h}{\ell}$$

$$W = b + 2(h + \frac{\Delta h}{2})$$

$$Q = \frac{1.49 \times [b(h + \frac{\Delta h}{2})] \times [\frac{b(h + \frac{\Delta h}{2})}{b + 2(h + \frac{\Delta h}{2})}]^{2/3} \times (\frac{\Delta h}{20})^{1/2}}{n}$$

$b = 13$ FT

$\ell = 20$ FT

$n = 0.03$

$h = 4'$

$$Q = \frac{1.49 \times [13 \times (4 + \frac{\Delta h}{2})] \times [\frac{13 \times (4 + \frac{\Delta h}{2})}{13 + 2 \times (4 + \frac{\Delta h}{2})}]^{2/3} \times (\frac{\Delta h}{20})^{1/2}}{0.03}$$

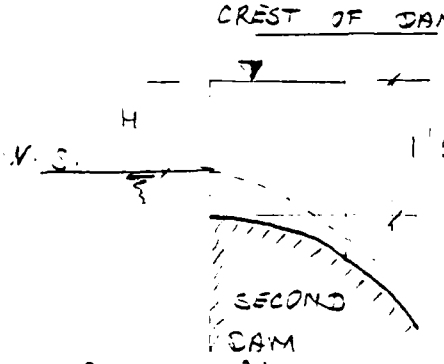
Δh	Q (cfs)	Δh	Q (cfs)
0.25	552	3.50	3255
0.50	814	3.75	3482
0.75	1038	4.00	3699
1.00	1241	4.25	3920
1.25	1428	4.50	4125
1.50	1606	4.75	4323
1.75	1773	5.00	4504
2.00	1931		
2.25	2081		
2.50	2224		
2.75	2361		
3.00	2492		
3.25	2618		

MAIN

Client CORPS OF ENGINEERS Job No. 345-072 Sheet 7 of 14

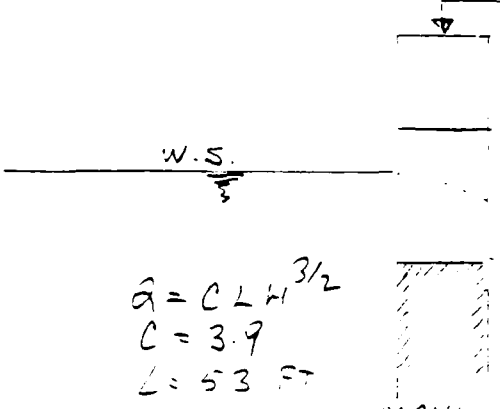
Subject PEMBROKE - COTTAGE DAM By T. SILVA Date 29-29-21

HYDROLOGY - HYDRAULICS Ckd. Rev.



$Q = C L H^{3/2}$ $C = 3.9$

$L_1 = 60$ FT $L_2 = 50$ FT



$Q = C L H^{3/2}$

$C = 3.9$

$L = 53$ FT

RATING TABLES

SECOND DAM SPILLWAY FIRST H (ft)	SECOND DAM SPILLWAY FIRST Q (cfs)	SECOND DAM SPILLWAY SECOND H (ft)	SECOND DAM SPILLWAY SECOND Q (cfs)	MAIN DAM SPILLWAY H (ft)	MAIN DAM SPILLWAY Q (cfs)
0.25	29	0.25	24	0.25	3
0.50	83	0.50	69	0.50	7.3
0.75	153	0.75	127	0.75	13.4
1.00	234	1.00	195	1.00	20.7
1.25	327	1.25	272	1.25	28.9
1.50	430	1.50	358	1.50	38.0
1.75	541	1.75	451	1.75	48.0
2.00	661	2.00	551	2.00	58.0
2.25	789	2.25	657	2.25	70.0
2.50	925	2.50	771	2.50	82.0
2.75	1067	2.75	889	2.75	94.0
3.00	1216	3.00	913	3.00	107.0
3.25	1371	3.25	1142	3.25	121.0
3.50	1532	3.50	1276	3.50	135.0
3.75	1699	3.75	1415	3.75	150.0
4.00	1872	4.00	1559	4.00	165.0
4.25	2050	4.25	1707	4.25	181.0
4.50	2233	4.50	1860	4.50	197.0
4.75	2422	4.75	2018	4.75	214.0
5.00	2615	5.00	2178	5.00	231.0

MAIN

Client CORPS OF ENGINEERS Job No. 1315-252 Sheet 3 of 14

Subject PEMBROKE - COTTAGE DAM By T. OTWA Date 22-22-8

HYDROLOGY - HYDRAULICS Ckd. Rev.

Combined Discharge Rating Table of all spillways

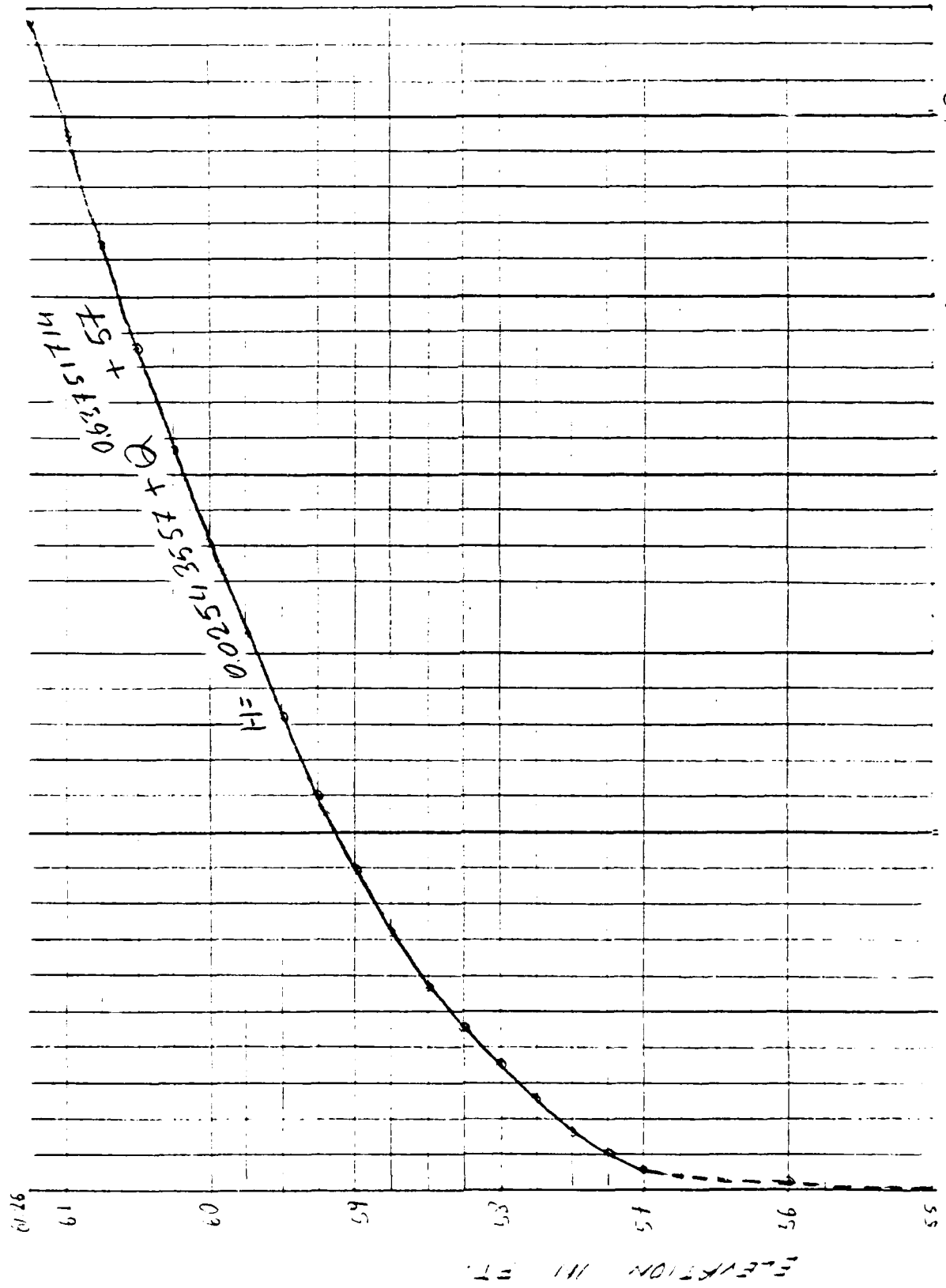
ELVATIONS	MAIN DAM	SECOND DAM FIRST SPILLWAY	SECOND DAM SECOND SPILLWAY	TOTAL DISC CFS
55.00	0.0			0.0
55.25	3.0			3.0
55.50	7.3			7.3
55.75	13.4			13.4
56.00	20.7			20.7
56.25	28.9			28.9
56.50	38.0			38.0
56.75	48.0			48.0
57.00	58.0	0.0		58.0
57.25	70.0	29.0		99.0
57.50	82.0	83.0		165.0
57.75	94.0	153.0		247.0
58.00	107.0	234.0		341.0
58.25	121.0	327.0		448.0
58.50	135.0	430.0	0.0	565.0
58.75	150.0	541.0	24.0	715.0
59.00	165.0	661.0	69.0	895.0
59.25	181.0	789.0	127.0	1097.0
59.50	197.0	925.0	195.0	1317.0
59.75	214.0	1067.0	272.0	1553.0
60.00	231.0	1216.0	358.0	1805.0
60.25	249.0	1371.0	451.0	2071.0
60.50	267.0	1532.0	551.0	2350.0
60.75	285.0	1699.0	657.0	2641.0
61.00	304.0	1872.0	771.0	2947
61.25	323.0	2050.0	889.0	3262

MAIN

Client CORPS OF ENGINEERS Job No. 1345-052-04 Sheet 9 of 14

Subject PEMBROKE - COTTAGE DAM By T OTOUR Date 22-IX-1981

HYDROLOGY - HYDRAULIC: Ckd. Rev.



MAIN

Client [illegible] Job No. [illegible] Sheet [illegible] of [illegible]
Subject [illegible] By [illegible] Date [illegible]
[illegible] Ckd. Rev.

ESTIMATING

EFFECT OF SURCHARGE STORAGE

ON MAXIMUM PROBABLE DISCHARGES

These calculations are
performed according to the
Corps of Engineers
Guidelines

PEMBROKE-COTTAGE DAM

D A T A

DRAINAGE AREA
A= 33 (sq.mi.)

PEAK INFLOW
Qp1= 14410 (cfs)

PRINCIPAL SPILLWAY CREST ELEV.
ELV1= 57 (ft)

EMERGENCY SPILLWAY CREST ELEV.
ELV2= 60 35 (ft)

Emergency Spillway Rating Curve
is defined as :

H = a * Q ^ b

a = 01947557
b = 63751714

The Capacity - Elv. curve
is defined as

Elv = m + n * Log(Volume)

m=-80 379
n= 11 037

TOTAL PMF RUNOFF
R= 17 [illegible]

CALCULATIONS

S T E P 1

[Re]duction of the Qp1 due to
[sto]ring elevation at
[Pri]ncipal Spillway crest elev

[Volu]me at 57 (ft)

[Volu]me1 =Exp((ELV1-m)/n)
[Volu]me1 = 84811.421 (ac-ft)

[Vol]ume at 60 35 (ft)

[Vol]ume2 =Exp((ELV2-m)/n)
[V]olume2 = 111872 336 (ac-ft)

Diff. of Volumes

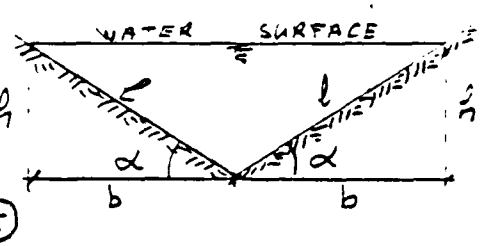
Diff Volume = 27060.916 (ac-ft)
or
Diff Volume, D= 13 91 (in.)

MAIN

Client CORPS OF ENGINEERS Job No. 1345-072 Sheet 1 of 14
Subject PEMBROKE COTTAGE DAM By T. OTOVA Date 22-IX-82
HYDROLOGY - HYDRAULICS Ckd. Rev.

DERIVATION OF STAGE - DISCHARGE RELATIONSHIP

The flood plain is assumed to have a triangular shape, for simplification reason.



Area, $A = \frac{h \times b}{2} \times 2 \qquad A = h \times b$

$\frac{h}{b} = \tan\alpha \qquad b = \frac{h}{\tan\alpha}$

$$\boxed{A = \frac{h^2}{\tan\alpha}} \quad (I)$$

Wetted Parameter, W,

$W = 2l \qquad \frac{b}{l} = \cos\alpha \qquad l = \frac{b}{\cos\alpha}$

$$\boxed{W = \frac{2b}{\cos\alpha}} \quad \ldots (II)$$

Hydraulic Radius, R,

$$R = \frac{A}{W} = \frac{bh}{2\frac{b}{\cos\alpha}} = \frac{h}{2} \times \cos\alpha$$

$$\boxed{R = \frac{h\cos\alpha}{2}} \quad \ldots (III)$$

Manning's Formula, $Q = \frac{1.49 \times A \times R^{2/3} \times S^{1/2}}{n}$

S is the channel slope
n is the roughness coefficient

By substituding in the formula A, R by the formulas I and II,

$$Q = \frac{1.49}{n} \times \frac{h^2}{\tan\alpha} \times \left(\frac{h \cdot \cos\alpha}{2}\right)^{2/3} \times S^{1/2} = \frac{1.49}{n} \times \frac{S^{1/2}}{\tan\alpha} \times \frac{(\cos\alpha)^{2/3}}{2^{2/3}} \times h^{8/3}$$

then,

$$h = \left[\frac{n \cdot \tan\alpha \times 2^{2/3}}{1.49 \times (\cos\alpha)^{2/3} \cdot S^{1/2}} \cdot Q\right]^{3/8}$$

or,

$$\boxed{h = \frac{1.066 \times n \cdot \tan\alpha}{(\cos\alpha)^{2/3} \cdot S^{1/2}} \cdot Q} \quad \ldots (IV)$$

MAIN

Client CORPS OF ENGINEERS Job No. 1345-0F2 Sheet 12 of 14
Subject PEMBROKE - COTTAGE DAM By I.STUCA Date 02-IX-1981
HYDROLOGY - HYDRAULICS Ckd. Rev.

The following calculations are performed by assuming that the "Main" dam will failure but the "North" dam and riadway will not fail. The reservoir volum between Main dam and North dam was estimated to be about 40 (ac-ft) and this was incorporated in failure calculation presented below.

PEMBROKE-COTTAGE
DAM FAILURE ANALYSIS

These calculations are performed according to the RULE OF THUMB procedures of the Corps of Engineers

The breach discharge
Qpl = 8.27 * Wb * a^0.5 * Yo^3.2

Where,

Yo is the height of the breach from river bed to the max pool level.

Wb is 35% of the length of the dam, or Wb = .35 * Wd

a is the acceleration of the grav (= 32.2 ft/sec^2)

Yo = 13 ft

Wd = 110 ft

Wb = 41 ft

From above equation,
Qpl = 5848 cfs

The natural channel cross sections are simplified as triangular cross sections

The stage-discharge relationship becomes as,

h = [1.068 * n * Tan(a) * Q / (Cos(a)^2.5 * S^0.5)]^0.38

Where,

Q = Discharge (cfs)
a = Side slope angle (deg)
S = Channel slope

The cross section Area

A = W * Tan(a) * H

The volume of the Reservoir
V = 40 (ac-ft)
or
V = 1742400 cu-ft

Client CORPS OF ENGINEERS Job No. 1345-07 Sheet 13 of 14
Subject PEMBROKE - COTTAGE DAM By T. [illegible] Date 08-IX-1981
HYDROLOG-1 - HYDRAULICS Ckd. Rev.

REACH 1 CALCULATIONS

Test flood discharge
Qt = 2100 (cfs)

a = 13.5 (deg)
F = .017
m = .05
L = 800 (ft)

From Formula (I)

Prefailure Height

h1 = 7.8 (ft)

From Formula (II)

A1 = 354 (sq ft)

Q = Qe1 + Qt

From Formula (I)
Total Height
h = 12.8 (ft)

From Formula (II)
Total Area
A = 690 (sq-ft)

Residual Area
A2 = A - A1
A2 = 436 (sq-ft)

Residual Volume

V1 = L * A2

V1 = 348800 (cub-ft)

Qe2 = Qe1 * (1 - V1 / V)

Qe2 = 4877 (cfs)

From Formula (I)

Q=Qe2+Qt

Q = [illegible] (cfs)

h = 13 (ft)

From Formula (II)

A = 812 (ft)

Residual Area

A2 = A - A1

A2 = 358 (ft)

V2 = A2 * L

V2 = 286566 (cub-ft)

Vave = (V1 + V2) / 2

Vave = 317695 (cub-ft)

Qe2 = Qe1 * (1 - Vave / V)

Qe2 = 4783 (cfs)

From Formula (I)

Q = Qe2 + Qt

h2 = 13.1 (ft)

RESULTS

1) Prefailure Height = 7.8 (ft)

2) Postfailure Height = 13.1 (ft)

3) Breach Discharge = 4783 (cfs)

4) Reach Length = 800 (ft)

MAIN

Client CORPS OF ENGINEERS Job No. 1345-072 Sheet 14 of 14
Subject PEMBROKE - COTTAGE By T. DIDIER Date 08-IX-(YR)
HYDROLOGY - HYDRAULICS Ckd. Rev.

REACH 3 CALCULATIONS

Test flood discharge
Qf = 2100 (cfs)

a = 13.5 (deg.)
S = .013
n = .05
L = 700 (ft)

From Formula (I)

Pretailure height

h1 = 7.8 (ft)

From Formula (II)

A1 = 354 (sq ft)

Q = Qe1 + Qf

From Formula (I)
Total Height
h = 13.1 (ft)

From Formula (II)
Total Area
A = 719 (sq-ft)

Residual Area
A2 = A - A1
A2 = 365 (sq-ft)

Residual Volume

V1 = L * A2

V1 = 255709 (cub-ft)

Qe2 = Qe1 * (1 - V1 / V)

Qe2 = 4080 (cfs)

From Formula (I)

Q=Qe2+Qf

Q = 6180 (cfs)

h = 11 (ft)

From Formula (II)

A = 571 (ft)

Residual Area

A3 = A - A1

A3 = 217 (ft)

V3 = A2 * L

V2 = 332088 (cub-ft)

Vave = (V1 + V2) / 2

Vave = 293898 (cub-ft)

Qe2 = Qe1 * (1 - Vave / V)

Qe2 = 4126 (cfs)

From Formula (I)

Q = Qe2 + Qf

h2 = 11.7 (ft)

RESULTS

1 - Pretailure Height = 7.8 (ft)

2 - Posttailure Height = 11.7 (ft)

3 - Breach Discharge = 4126 (cfs)

4 - Reach Length = 700 (ft)

MAIN

Client CORPS OF ENGINEERS Job No. 1345-042 Sheet 14A of 14
Subject PEMBROKE - COTTAGE By T. OTOWA Date 08-IX-1981
HYDROLOGY - HYDRAULICS Ckd. Rev.

REACH 3 CALCULATIONS

Test flood discharge
Qt = 3100 (cfs)

a = 2.43 (deg)
S = .013
n = .05
L = 500 (ft)

From Formula (I)

Pretailure height

h1 = 4.6 (ft)

From Formula (II)

A1 = 355 (sq.ft)

Q = Qf1 + Qt

From Formula (I)
Total Height
h = 6.3 (ft)

From Formula (II)
Total Area
A = 802 (sq-ft)

Residual Area
A2 = A - A1
A2 = 447 (sq-ft)

Residual Volume

V1 = L * A2

V1 = 223739 (cub-ft)

Qf2 = Qf1 * (1 - V1 / V)

Qf2 = 3586 (cfs)

From Formula (I)

Q=Qf2+Qt

= 5686 (cfs)

h = 6 (ft)

From Formula (II)

A = 750 (ft)

Residual Area

A2 = A - A1

A2 = 395 (ft)

V2 = A2 * L

V2 = 197831 (cub-ft)

Vave = (V1 + V2) / 2

Vave = 210780 (cub-ft)

Qf2 = Qf1 * (1 - Vave / V)

Qf2 = 3637 (cfs)

From Formula (I)

Q = Qf2 + Qt

h2 = 6.7 (ft)

RESULTS

1 - Pretailure Height = 4.6 (ft)

2 - Pretailure Height = 6.7 (ft)

3 - Breach Discharge = 3637 (cfs)

4 - Breach Length = 500 (ft)

APPENDIX E - INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

PART I – INVENTORY OF DAMS IN THE UNITED STATES

(PURSUANT TO PUBLIC LAW 92-367)

See reverse side for instructions

FORM APPROVED
OMB NO. 49-R0421

REQUIREMENTS CONTROL SYMBOL
DAEN-CWE-17

[1] STATE / IDENTITY NUMBER (1–7): NE 00294

IDENTIFICATION	[2] DIVISION	[3] STATE	[4] COUNTY	[5] CONGR DIST	[6] STATE	[7] COUNTY	[8] CONGR DIST	[9] NAME	[10] LATITUDE (North)	[11] LONGITUDE (West)	[12] REPORT DATE DAY MO YR	
	NED	ME	023	2				[illegible]	4457.8	6609.1	30SEP81	0

IDENTIFICATION (Continued)	[13] POPULAR NAME	[14] NAME OF IMPOUNDMENT	
	[illegible]	[illegible]	1

LOCATION	[15] REGION	[16] BASIN	[17] RIVER OR STREAM	[18] NEAREST DOWNSTREAM CITY – TOWN – VILLAGE	[19] DIST FROM DAM (mi)	[20] POPULATION	
	01	01	[illegible]	[illegible]	6.5	500	2

STATISTICS	[21] TYPE OF DAM	[22] YEAR COMPLETED	[23] PURPOSES	[24] STRUCTURAL HEIGHT (ft)	[25] HYDRAULIC HEIGHT (ft)	[26] IMPOUNDING CAPACITIES MAXIMUM	[27] NORMAL	[27A] CORPS ENGR. DIST.	[27B] OWN.	[27C] FED. R	[27D] PRV FED	[27E] SCS A	[27F] VERIFICATION DATE DA MO YR	BLANK	
	[illegible]	[illegible]	[illegible]				[illegible]	[illegible]							3

REMARKS	[28] REMARKS	
	[illegible]	4

PART II – INVENTORY OF DAMS IN THE UNITED STATES

(PURSUANT TO PUBLIC LAW 92-367)

See reverse side for instructions

FORM APPROVED
OMB NO. 49-R0421

REQUIREMENTS CONTROL SYMBOL
DAEN-CWE-17

[1]

STATE (1–2)	IDENTITY NUMBER (3–7)
[illegible]	[illegible]

STATISTICS

[29] [30] [31] [32] [33] [34] [35] [36] [37] [38] [39] [40] [41] [42] [43] [44] [45]

D S HAZ (8)	CREST LENGTH (ft) (9–13)	SPILLWAY TYPE (14)	SPILLWAY WIDTH (ft) (15–18)	SPILLWAY MAXIMUM DISCHARGE (cfs) (19–25)	VOLUME OF DAM (CY) (26–34)	POWER CAPACITY INSTALLED (MW) (35–40)	POWER CAPACITY PROPOSED (MW) (41–46)	NAVIGATION LOCKS NO (47)	LENGTH (ft)	WIDTH (ft)	LENGTH (ft)	WIDTH (ft)	LENGTH (ft)	WIDTH (ft)	LENGTH (ft)	WIDTH (ft)	BLANK (76–80)
1	[illegible]	[illegible]	3	[illegible]	1500												

5

MISC DATA

OWNER [46] (8–31)	ENGINEERING BY [47] (32–55)	CONSTRUCTION BY [48] (56–79)
[illegible]		

6

MISC DATA (Continued)

REGULATORY AGENCY

DESIGN [49] (8–25)	CONSTRUCTION [50] (26–43)	OPERATION [51] (44–61)	MAINTENANCE [52] (62–79)

7

MISC DATA (Continued)

INSPECTION BY [53] (8–40)	INSPECTION DATE [54] DAY / MO / YR (41–46)	AUTHORITY FOR INSPECTION [55] (47–79)
[illegible]	[illegible]	

8

REMARKS

[56]

REMARKS (8–79)

9

ENG FORM 1 DEC 77 4474A

PART III - INVENTORY OF DAMS IN THE UNITED STATES
SUPPLEMENTARY DATA

STATE	IDENTITY NUMBER
ME	0 0 2 [illegible] 4

LOCATION

(A-1) TOWN	(A-2) NED PERMIT NO	(A-3) STATE NUMBER	(A-4) FERC NO	(A-5) USGS SHEET	
PEM[illegible]E				[illegible] ME	A

DRAINAGE CHARACTERISTICS

(B-1) DRAINAGE AREA SQ MI	(B-2) FLOW DATA MIN CFS	(B-3) FLOW DATA AVE CFS	(B-4) FLOW DATA MAX CFS	(B-5) CREST ELEV MSL	(B-6) ABUT ELEV MSL	(B-7) USABLE STORAGE ACRE FEET	(B-8) RESERVOIR AREA ACRES	(B-9) FLASH BOARD HT FEET	(B-10) OUTLET CONDUITS NO	(B-11) OUTLET CONDUITS SIZE	(B-12) INVERT ELEV MSL	
[illegible]				[illegible]	[illegible]		[illegible]		[illegible]	[illegible]	[illegible]	B

POWER DATA

(C-1) GENERATION UNITS INSTALLED NO	CAP KW	(C-2) GENERATION UNITS PLANNED NO	CAP KW	(C-3) AVERAGE ANNUAL GENERATION KWH	(C-4) LAST GEN YEAR	(C-5) RETIRED YEAR	(C-6) FORMER USE	(C-7) CAPACITY FACTOR	
									C

[illegible]	D
[illegible]	E

[illegible] FORM [illegible]

PART I – INVENTORY OF DAMS IN THE UNITED STATES

(PURSUANT TO PUBLIC LAW 92-367)

See reverse side for instructions

FORM APPROVED
OMB NO. 49-R0421

REQUIREMENTS CONTROL SYMBOL
DAEN-CWE-17

[1]

STATE	IDENTITY NUMBER
1 2	3 4 5 6 7
[illegible]	[illegible]

[2] [3] [4] [5] [6] [7] [8] [9] [10] [11] [12]

IDENTIFICATION	DIVISION	STATE	COUNTY	CONGR DIST	STATE	COUNTY	CONGR DIST	NAME	LATITUDE (North)	LONGITUDE (West)	REPORT DATE DAY MO YR	0
	[illegible]	[illegible]		[illegible]				[illegible]	[illegible]	[illegible]	[illegible]	

[13] [14]

IDENTIFICATION (Continued)	POPULAR NAME	NAME OF IMPOUNDMENT	1
		[illegible]	

[15] [16] [17] [18] [19] [20]

LOCATION	REGION	BASIN	RIVER OR STREAM	NEAREST DOWNSTREAM CITY – TOWN – VILLAGE	DIST FROM DAM (mi)	POPULATION	2
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	

[21] [22] [23] [24] [25] [26] [27] [27A] [27B] [27C] [27D] [27E] [27F]

STATISTICS	TYPE OF DAM	YEAR COMPLETED	PURPOSES	STRUCTURAL HEIGHT (ft)	HYDRAULIC HEIGHT (ft)	IMPOUNDING CAPACITIES MAXIMUM (acre-ft)	IMPOUNDING CAPACITIES NORMAL (acre-ft)	CORPS ENGR. DIST	OWN	FED R	PRV FED	SCS A	VERIFICATION DATE DA MO YR	BLANK	3
	[illegible]	[illegible]	[illegible]		[illegible]		[illegible]								

25

REMARKS	REMARKS	4
	[illegible]	

ENG FORM 4474

PART II – INVENTORY OF DAMS IN THE UNITED STATES

(PURSUANT TO PUBLIC LAW 92-367)

See reverse side for instructions

FORM APPROVED
OMB NO. 49-R0421
REQUIREMENTS CONTROL SYMBOL
DAEN-CWE-17

[1] STATE (1–2) | IDENTITY NUMBER (3–7)

STATISTICS

[29] D/S HAZ · [30] CREST LENGTH (ft) · [31] SPILLWAY TYPE · [32] SPILLWAY WIDTH (ft) · [33] SPILLWAY MAXIMUM DISCHARGE (cfs) · [34] VOLUME OF DAM (CY) · [35] POWER CAPACITY INSTALLED (MW) · [36] POWER CAPACITY PROPOSED (MW) · [37] NAVIGATION LOCKS NO · [38] LENGTH (ft) · [39] WIDTH (ft) · [40] LENGTH (ft) · [41] WIDTH (ft) · [42] LENGTH (ft) · [43] WIDTH (ft) · [44] LENGTH (ft) · [45] WIDTH (ft) · BLANK — 5

MISC DATA

[46] OWNER · [47] ENGINEERING BY · [48] CONSTRUCTION BY — 6

MISC DATA (Continued)

REGULATORY AGENCY: [49] DESIGN · [50] CONSTRUCTION · [51] OPERATION · [52] MAINTENANCE — 7

MISC DATA (Continued)

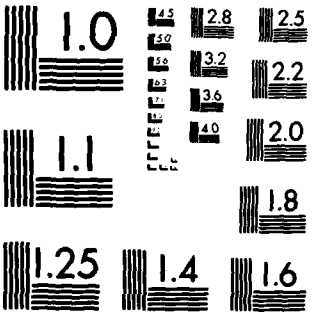
[53] INSPECTION BY · [54] INSPECTION DATE (DAY MO YR) · [55] AUTHORITY FOR INSPECTION — 8

REMARKS

[56] REMARKS — 9

AD-A155 370 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS 2/2
PEMBROKE COTTAGE MAIN (U) CORPS OF ENGINEERS WALTHAM
MA NEW ENGLAND DIV SEP 81
F/G 13/13 NL

UNCLASSIFIED



PART III - INVENTORY OF DAMS IN THE UNITED STATES
SUPPLEMENTARY DATA

STATE	IDENTITY NUMBER
ME	[illegible]

LOCATION (A)

TOWN (A-1)	NED PERMIT NO (A-2)	STATE NUMBER (A-3)	FERC NO (A-4)	USGS SHEET (A-5)
[illegible]				[illegible]

DRAINAGE CHARACTERISTICS (B)

DRAINAGE AREA SQ MI (B-1)	FLOW DATA MIN CFS (B-2)	FLOW DATA AVE CFS (B-3)	FLOW DATA MAX CFS (B-4)	CREST ELEV MSL (B-5)	ABUT ELEV MSL (B-6)	USABLE STORAGE ACRE FEET (B-7)	RESERVOIR AREA ACRES (B-8)	FLASH BOARD HT FEET (B-9)	OUTLET CONDUITS NO (B-10)	OUTLET CONDUITS SIZE (B-11)	INVERT ELEV MSL (B-12)
37.				[illegible]	[illegible]	[illegible]	[illegible]		1	7'x7'6"	51.5

POWER DATA (C)

GENERATION UNITS INSTALLED NO (C-1)	INSTALLED CAP KW	PLANNED NO (C-2)	PLANNED CAP KW	AVERAGE ANNUAL GENERATION KWH (C-3)	LAST GEN YEAR (C-4)	RETIRED YEAR (C-5)	FORMER USE (C-6)	CAPACITY FACTOR (C-7)

(D) [illegible]

(E)

NED FORM 80(TEST)

END

FILMED

7-85

DTIC